AMERICAN MACHINIST

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Improved Form of the Moore Water-Tube Boiler.

The engravings shown herewith represent the latest improved form of the Moore water-tube boiler, having a longitudinal steam and water drum in which the water is carried about half-way up, thus securing a large disengaging surface for the steam, and giving steadiness to the water line by carrying a sufficient supply of water.

A number of inclined sections are fastened to the drum at the front end by means of short boiler tubes, which are expanded into the upper side of the top section of each row, and to the bottom side of a saddle which is firmly riveted to the drum.

The same mode of connecting the rear end of the section with the back end of the drum is used, only, instead of short pieces of boiler tube being employed, much longer pieces are made use of, and by this means, an inclination is given to the entire nest of sections. The circulation of the water is always in one direction, and a glance at the larger cut will show that the circulation must be positive, following the inclined tubes upward towards the front of the drum, thence through same to the rear, and down the vertical tubes to the sections again. This is to secure rapid steaming and clean surface in the tubes.

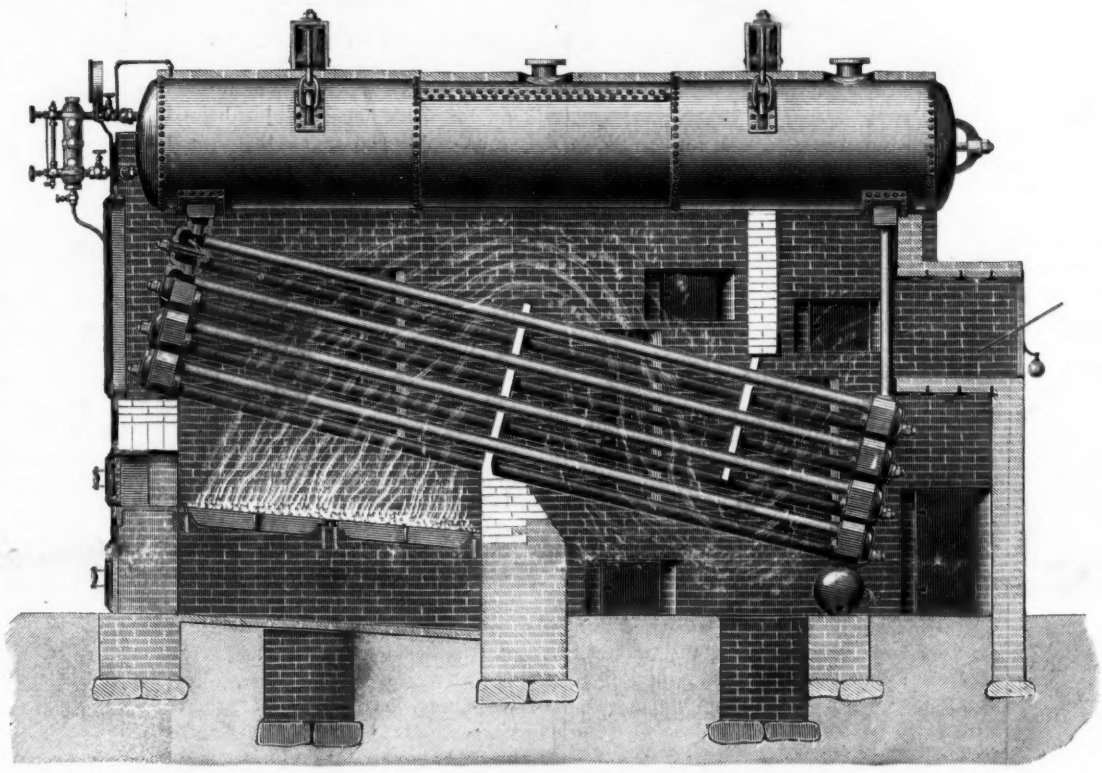
One of the important improvements in this boiler, is the use of Moore's sectional headers, which are triangular in form, and each of which encloses the end of three tubes. These headers have a triangular opening on the outer side. When in use, the opening is closed by means of a triangular plate or cover, held in place by a single heavy wrought-iron bolt and cap.

By removing this triangular plate, which can be readily done, three tubes are exposed for examination, cleaning and repairs. A man-hole is also provided for access to the interior of the drum, and hand-holes for access to the mud drum. The sections composing the boiler are placed one above the other to the height required, thus forming what might be called a "compound section." The tubes are put in a "staggered" position in order to break up the direct currents of heated gases and utilize them to the greatest extent.

Each triangular header is connected to the one immediately above and below it, by means of short pieces of boiler tubes expanded into bored holes in each header, so that the joints are firmly made. No screw joints are used in the construction of this boiler.

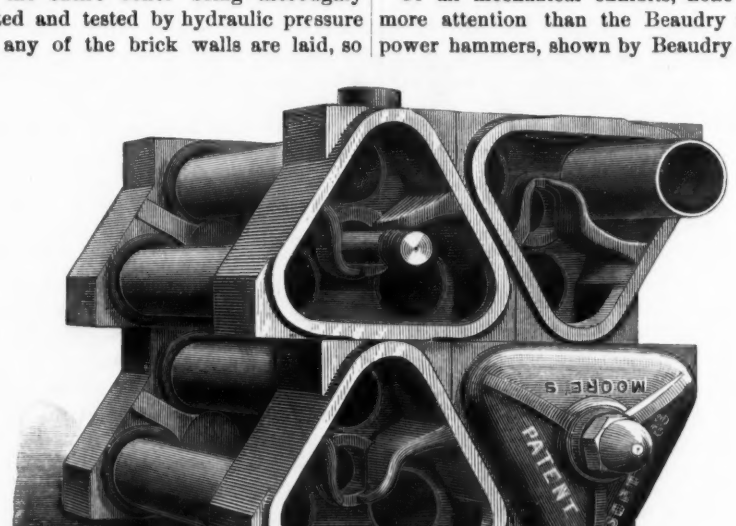
By using sectional headers, connected together by expanded boiler tubes, a certain amount of elasticity in the water-tube part of the boiler is obtained, allowing for unequal expansion and contraction.

The entire boiler is suspended from two over-head girders by means of eye-bolts, links, and four hook plates, the latter being riveted to the drum some distance in towards the center of the drum from each end. The girders are supported by four iron columns—not shown in the engraving—which act as binders or stays for the brick work.



MOORE WATER-TUBE BOILER.

In erecting a boiler it is first swung from the supporting girders, and all connections made, the entire boiler being thoroughly inspected and tested by hydraulic pressure before any of the brick walls are laid, so that the boiler proper, and the brick work enclosing same, are entirely independent of each other. The flue leading to the chimney is separated from the back connection chamber by a brick wall which prevents dust or ashes from collecting in the chamber. Separating the flue and chamber in this manner, admits of entrance to the chamber while the boiler is under fire. Doors placed in the side walls afford access to the exterior of the tubes, and permit the use of a steam jet for the purpose of cleaning the outside of the tubes. These boilers are manufactured by the National Water-Tube Boiler Company, New Brunswick, N. J.



SECTIONAL HEADER FOR MOORE BOILER.

Fair of the American Institute.

Of all mechanical exhibits, none claims more attention than the Beaudry upright power hammers, shown by Beaudry & Cunningham, Boston, Mass. This is largely due to the fact that they are doing actual work a good deal of the time. There is always something about tools or machines, at a fair, in operation as they would be in the manufactory, that attracts not only the mechanic but the curious as well. The rapid blows of these hammers advertise their locality, and are so suggestive of the busy workshop as to draw a crowd towards and around them. One of them, a small one, is frequently seen at work on knife blades of various kinds, which are boxed and shipped as fast as forged. The rapidity with which the work is executed, and especially the easy-going attitude of the comfortably seated operator, disturb a good deal of the poetic sentiment connected with the earlier disciples of Tubal Cain and their surroundings. A larger hammer may frequently be found beating out heavier work. These hammers are the invention of practical mechanics who know how to operate as well as to build them. Several improvements have recently been made in their construction, and those familiar with the use of such tools, speak in their praise.

The Delamater Iron Works, 16 Cortlandt street, New York, make their usual good display of pumps and pumping machinery, including the Rider compression pumping engine, and the Ericsson hot-air pumping engine. These small pumping engines work about as smoothly as a clock, and, requiring only the attention of a house servant, get a good deal of notice from those who can see use for a pump, the service of which will carry along with it no danger from explosion or fire.

A. & F. Brown, 43 Park Place, New York, have on exhibition a fine display of finished steel shafting, also pulleys, hangers and other line-shaft belongings. This exhibit is instructive as showing the extent to which steel shafting, in late years so cheapened in price, has come into use.

A. J. Crouthers, 12 Cortlandt street, New York, shows a Nagle steam pump at work, also a Baragwanath feed-water heater, a "Standard" injector, etc.

Hine & Robertson have feed pumps, steam gauges, radiators and other steam appliances. The damper for the boilers furnishing steam to the exhibitors is controlled by the Kellam damper regulator, put up by this firm.

Modern engineering calls for high-speed shafting, and, consequently, for narrow belts and pulley-faces.

An entertainment is to be given at Irving Hall, New York City, on the evening of December 18, for the benefit of J. E Hall, a disabled machinist. The entertainment will take place under the auspices of the Mascot Social Circle, an organization of machinists for social purposes.

A piece of 1" steam pipe in the service of the New York Steam Heating Company, got to leaking and was dug up. The pipe was completely corroded through for 12" of its length, and fell in pieces while being removed. "Coal ashes and cinders were the cause of that trouble," said the engineer in charge. "A pipe soon gives out when it is buried in cinder."

Laying Out Step Pulleys—Fan-Blowers—Mending a Broken Pulley.

BY JAMES F. HOBART.

The other day we saw a machinist laying out a step-pulley—"cone" pulleys, most of the boys call them, but that is not the right name.

Our man was rigging up a speed-lathe which had been burned. The overhead step-pulley was all right, and ran 750 per minute. The steps of the counter-pulley were 3″, 6″, 9″ and 12″ in diameter, and required to run the lathe spindle 3,000 and 1875, and at two intermediate speeds.

The proportion 750 : 3000 : : 3 : (?) gave 12″ as size of the largest step, and 750 : 1875 : : 12 : (?) gave 3″ for the small step. The ceiling of the shop was very low, and there were but four feet between centers of counter and spindle.

He had found by experience that if he made the two middle steps in proportion with the two outside steps, that his belt would be loose when put upon them. He found the length of belt required, took said length as radius, and described an arc on the floor. Then he drew a chord of the arc, equal in length to the distance from center of big step to center of little step.

He then laid off the centers of intermediate steps upon the chord, and carried them to the circumference of the described arc for the size required to take up the loose belt. Do you see it? Instead of making the pulley so that a straight-edge would touch a corner of each step, he made them touch the inside of a circle whose radius equaled length of belt which was to drive the pulley.

Here is a puzzle for you. The belt ran all right. It fitted upon each set of steps, but we should not dare to figure out the rule. Let him who has the "least twisted arithmetic" tell how this rule was right.

Did you ever get into trouble with a fan-blower?

They are queer things. A certain individual has one 36″ in diameter, and he found out some queer things about it.

Said blower did not do work enough, so he took off the 18″ pulley which drove the fan, and put on one 36″ in diameter. Pretty soon the engineer was heard from. He declared that blower was taking more power than all the rest of the shop. The proprietor came down, looked at the indicator cards, stopped the blower, took more cards, and went to figuring. He found that doubling the speed of the blower gave him double the quantity of air, gave four times the pressure of blast, and used up *eight* times the power!

The blower used four horse-power with the 18″ pulley, and took 32 horse-power from the 36″ pulley.

He doesn't double up blower speeds, haphazard, any more.

A shopman had a broken pulley to mend. It was a $28 \times 5 \times 1\frac{7}{16}$″. One arm broke off close to the rim when the thing was cast. A piece of rim got broke out by accident, and now somebody has dropped a coupling on that pulley, and knocked off all the rim from between two arms.

The shopman took his hammer and knocked off all the rest of the rim. He was careful to save the arms, and broke the iron from them clean and carefully.

He made a wooden rim, and cut large mortises for ends of the arms. When the rim got dry, after gluing up, he centered the arms and hub in the rim, and poured melted brimstone around the end of each arm where it lay in the mortise left for it in the wooden rim. The shopman turned up the wooden rim, balanced it, and a better pulley never was seen.

Many men try this trick. Sometimes a cast-iron pulley will fail to drive the belt. The rim is knocked off, a wooden one built on, and that pulley gets right down to business.

It is the best way to lag up a pulley. Better than drilling holes and screwing on lags, unless for a very wide face, for heavy work.

Shop Notes.

The ordinary steady rest often proves a poor tool. Too much time is required to rig it up.

For light work, the steady rest shown in Fig. 6 is good. It was designed for use on a Fox lathe, by Mr. Corbin, of the Rue Manufacturing Company, 907 Filbert Street, Philadelphia.

Fred Corbin, the maker of the rest, says it is easily and quickly adjusted to any size of work within 3″, the diameter of central hole. The chuck proper is cast iron, in one piece. The three jaws are brass. They are set up to the work by three set-screws, which in turn are held by jamb nuts.

The perpendicular shank enables the chuck to be held in place by a set screw. This chuck can be easily adapted for use on an ordinary lathe.

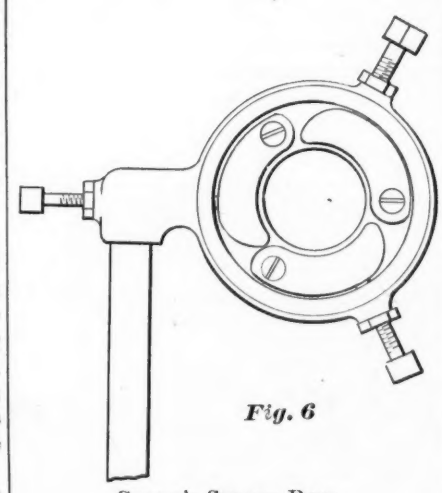


Fig. 6

CORBIN'S STEADY REST.

Reconstructing a Dismantled Railroad for War Purposes.

By kind permission of the editor of the *Century* magazine, we reproduce from the November number of that periodical the following extract from Gen. Grant's paper, entitled "Chattanooga," graphically describing the manner in which a dismantled railroad was reconstructed during the American civil war:

Sherman's force made an additional army, with cavalry, artillery and trains, all to be supplied by the single-track road from Nashville. All indications pointed also to the probable necessity of supplying Burnside's command, in East Tennessee, twenty-five thousand more, by the same road. A single track could not do this. I gave, therefore, an order to Sherman to halt General G. M. Dodge's command of eight thousand men at Athens, and subsequently directed the latter to arrange his troops along the railroad from Decatur north towards Nashville, and to rebuild that road. The road from Nashville to Decatur passes over a broken country, cut up with innumerable streams, many of them of considerable width, and with valleys far below the road-bed. All the bridges over these had been destroyed by the enemy, and the rails taken up and twisted. All the locomotives and cars not carried off had been destroyed as effectually as they knew how. All bridges and culverts had been destroyed between Nashville and Decatur, and thence to Stevenson, where the Memphis and Charleston and the Nashville and Chattanooga roads unite. The rebuilding of this road would give us two roads as far as Stevenson over which to supply the army. From Bridgeport, a short distance further east, the river supplements the road.

Gen. Dodge, besides being a most capable soldier, was an experienced railroad builder. He had no tools to work with but those of the pioneers—axes, picks and spades. With these he was able to intrench his men, and protect them against surprises by small parties of the enemy. As he had no base of supplies until the road could be completed back to Nashville, the first matter to consider, after protecting his men, was the getting in of food and forage from the surrounding country. He had his men and teams bring in all the grain they could find, or all they needed, and all the cattle for beef, and such other food as could be found. Millers were detailed from the ranks to run the mills along the line of the army; when these were not near enough to the troops for protection, they were taken down and moved up to the line of the road. Blacksmith shops, with all the iron and steel found in them, were moved up in like manner. Blacksmiths were detailed and set to work making the tools necessary in railroad and bridge building. Axemen were put to work getting out timber for bridges, and cutting fuel for the locomotives when the road was completed; car-builders were set to work repairing the locomotives and cars. Thus every branch of railroad building, making tools to work with, and supplying the workmen with food, was all going on at once, and without the aid of a mechanic or laborer except what the command itself furnished. But rails and cars the men could not make without the material, and there was not enough rolling stock to keep the road we already had, worked to its full capacity. There were no rails except those in use. To supply these deficiencies I ordered eight of the ten engines General McPherson had at Vicksburg to be sent to Nashville, and all the cars he had, except ten. I also ordered the troops in West Tennessee to points on the river and the Memphis and Charleston road, and the cars, locomotives, and rails from other railroads to be sent to the same destination. The military manager of railroads also was directed to furnish more rolling stock, and as far as he could, bridge material. General Dodge had the work assigned him finished within forty days after receiving his order. The number of bridges to rebuild was one hundred and eighty-two, many of them over deep and wide chasms. The length of road repaired was one hundred and two miles.

Drops and Drop Forgings.

Mr. Matthew Diamond gave an interesting talk on the above named subject before the Polytechnic Association of the American Institute at their last meeting. He thought it very difficult to trace the history of this industry.

He thought that all the manufacturers of drop hammers should pool their best points.

Mr. Diamond said the man who puts up a drop without a proper foundation has a constant and expensive source of trouble ever to contend with. If the ground is soft, piles should be driven in the place where the drop is to stand. My plan after these piles have been thoroughly driven, is to place on the top a block of granite 4 to 5 feet square and 1½ to 2 feet thick, leveled so that the top and bottom should be parallel. This block of granite should be at least six feet below the floor. On the granite place timbers endwise, preferably white oak, bolted together to suit base and height of drop.

Die making, he said, is of the greatest importance. Many things connected with this work do not appear on the surface. In designing and constructing what are called break-down dies, it is important to save the labor of forming the rough stock, which comes on the finishing dies. If the rough stock does so come on the dies, the dies will soon be destroyed.

Attempting to forge without break-down dies is merely stamping, and cannot be called forging. I worked at the anvil for 22 years, and have some idea of where metal will go, when the force of a blow is applied, and combining my previous knowledge with what I gained by the use of machinery, I find drop-forging to be simply blacksmithing by machinery.

Having procured the best steel, after it has been properly annealed, the impression is sunk. A man can then very readily lay out from $50 to $150 in labor and material on a pair of dies. Then comes the anxiety of hardening. If he fails to harden his dies properly, or if a die should crack in the process he has lost so much labor and material. Both skill and practice are required in hardening a die, and the best way for a beginner is to make his dies at his own expense as I did, and that will sharpen up his wits considerably, I am sure.

The ordinary way of hardening dies, is to harden the whole surface, but the water takes hold of the corners quicker than the center. To overcome this, I do not harden the corners, but simply harden the impression.

My method is inexpensive. I take a piece of inch board, and cut a piece out the shape of the impression. I lay the heated die on the board, and cool it by means of water brought under pressure through a vertical pipe, flowing through the hole in the board upon the impression, and cooling that part of the die first. The heated die burns or beds itself into the board, so that water cannot strike any part of the die except the impression.

The tendency of the die is to be convex after hardening. To guard against this, after heating, the shank is cooled first, the face requiring to be watched closely, to see that the heat is sufficient for hardening when the die is turned over.

An important element in hardening is the heat, and care should be taken to heat evenly, and not too rapidly. I do not cool my dies dead cold, but endeavor to get as uniform a temperature as possible.

We do not count blows in forging. The heat and size of the forging determine the number of blows.

Sometimes hot trimming is necessary, and at other times not, the use of the hot trimmer depending mainly on the size of the forging, as small forgings can usually be trimmed cold.

In the break-down process we must be very careful to allow stock enough for the finish, and we like to see a fin all the way around the forging, as evidence that the impression is filled. If we continue to hammer the forging without removing the fin, the dies will soon be destroyed. We therefore place the forging in a press and trim off the surplus stuff, and if necessary re-heat and repeat the process in the drop.

In the subsequent discussion Mr. Marsden, of Ansonia, Conn., said: "In my drop-forging experience hundreds of dollars might have been saved had I possessed the knowledge gained from Mr. Diamond's address. We used a process of hardening by heating in a bath of cyanide of potassium and cooling in chloride of silver, and the result is a very thorough hardening for small work, although much too expensive for general use."

Replying to Mr. Marsden's remarks, Mr. Diamond said he would not advise any one to harden dies in that way, as they could not be hardened deep enough, and the result would be more in the nature of case-hardening, or surface-hardening.

Mr. Marsden replied, that in drawing brass tubes through a die hardened by this process, the die will do 100 per cent. more work than a die hardened by heating in the fire and cooling in water. He did not know whether the method of hardening by the potassium bath already mentioned, would have an effect upon the steel, or not. A file or steel instrument hardened in this way would cut glass readily.

Mr. Diamond resumed by saying that the fumes from the chemical used in the process referred to by Mr. Marsden, were very dangerous, because poisonous, and advising great care in the use of that process. He had used that process for hardening delicate springs and small work, but would not recommend it for hardening a thick mass of metal.

The following figures in relation to machinery used on German farms, taken from a recently published volume of imperial statistics, are interesting at the present time. Of 5,276,344 farms, only 391,746 used machinery at all. Of these, 836 used steam ploughs, 63,842 sowing machines, 19,634 mowing machines, and 374,057 used steam or other threshing machines. Thus not much over 7 per cent. used machinery at all, and of these by far the larger proportion only the threshing machine. Three-fourths of the whole agricultural industry used no machinery, 4,000,000 peasants dispensing with it altogether. The farms between 25 and 125 acres, numbering roughly 600,000, employed in round figures 213,000 threshing machines.

The editor of the Emporia (Fla.) *Gazette* sends us a sprig of Florida mistletoe, which he guarantees to be suitable for Christmas purposes, having worked well in Florida. It is accompanied by a number of interesting statements of fact relating to the lands and development of that State.

Staten Island as a Manufacturing Point.

A bright New York weekly newspaper, *The Hour*, referring to the line of railroad which the Baltimore & Ohio Co. proposes to carry into Staten Island in New York harbor, and the extensive terminal facilities that will be located there, if the plan succeeds, has the following:

A very few thousand families, whose heads do business in New York, live on Staten Island, but the entire population is only about 40,000, although the area is nearly sixty square miles—more than that of New York City with the annexed district included. Equally strange, and less explicable, is the unanimity with which manufacturers avoid Staten Island. Heavy milling is generally conducted by preference, where land is cheap and transportation can be entirely by water. Staten Island has a larger water front than Manhatten Island and Brooklyn combined, and the land is so cheap and abundant that any one can select his site and build a dock, but there are fewer factories on the whole island than may be found on a single mile of the Brooklyn shore. Newark, nearly ten miles farther by water, is full of mills, the output of which comes to New York by water, passing miles of the Staten Island shore *en route*. Opposite one part of Staten Island, and only six hundred feet away, the New Jersey shore is crowded with factories. Opposite another shore of Staten Island are continuous miles of warehouses in Brooklyn; a tortoise could crawl past all of Staten Island's warehouses in five minutes.

A New Motor for Vessels.

A correspondent, who signs himself "Engineer," is anxious that we should inquire into the merits of a new vessel recently launched in Brooklyn, which is to be equipped with motive power, according to one of our flaming daily newspaper accounts, as follows:

In the center of the Eureka is a small coal boiler which furnishes the motive power for two air pumps or air compressors placed just abaft it. This boiler will also run a small dynamo engine which is to generate the electricity, which is really the prime mover. Above the four ports or orifices in the boat, and communicating with them by valves, is placed a steel globe two feet in diameter, into which the air is compressed. Into these globes a spray of petroleum is forced and an electric spark causes the explosion through two of the orifices—either the two leading aft or the two leading forward—which will exercise a thrusting force of fifteen tons on either side of the vessel, and these, it is said, may be regulated from two to sixty a minute.

We can assure our anxious correspondent that we shall not fail to observe the performances of the new nautical motor, but before becoming enthusiastic, we think it best to wait and see whether the new motor is really going to "mote," or whether the formation of a big stock company is all that lies behind the glowing accounts published by the daily press.

An Engine with two Connecting-Rods.

Two connecting-rods attached to one crosshead is a novelty in the construction of engines, but may be made a useful point under certain conditions. The above method is used by Thwaites Brothers, Bradford, England, for connecting an upright engine with a Root blower.

Prof. Sweet and Cornell University.

The following communication from Prof. Sweet, referring to a recent paragraph which appeared in our columns, explains itself:

Editor American Machinist:

The notice in the AMERICAN MACHINIST, of December 5th, setting forth that I had been "earnestly invited" to take my old position at Cornell University is liable to a decided misconstruction. While some of my friends at Ithaca have expressed such a desire, it is probable that the thought or wish never entered the minds of the authorities.

JOHN E. SWEET.

A foot pavement composed of iron slag, powdered and laid in cement, has been laid in a portion of the Strand, London. If the experiment succeeds, this will form a new utilization of this waste product.—*Iron Age.*

Improvement in Drill-Chucks.

The illustrations given herewith represent a recent improvement in Wescott's Little Giant drill-chuck, as manufactured by the Oneida Steam Engine and Foundry Company, N. Y.

Some mechanics want a chuck made so strong that it will break a drill before letting it slip. This is not a very reasonable desire, as a drill should be allowed to slip rather than to break.

The question has been compromised in the construction of the chuck here shown, by putting in two set screws, one on each side of the chuck, at right angles with the jaws. These screws may be used or not, as desired. With their aid a large drill may be held strongly enough to break it, and bolts may be held for threading.

Machinists require a great deal from a chuck now-a-days; it must have an immense gripping power, concentrated into a very small space. By combining in one chuck the jaws, which are moved by a right and left screw, and the two set-screws, the gripping power of two chucks is obtained, viz., the old-fashioned set-screw chuck, and the improved chuck with right and left screw.

IMPROVEMENT IN DRILL CHUCKS.

A New Scythe.

A novelty in the scythe line is being put upon the market by the Tubular Blade Company, Tribune Building, New York. The old style of scythe requires fifteen heatings, and more than twenty distinct operations to complete the work of manufacture. The "tubular-blade" scythe requires but three heatings, substituting drop-forging for hand and trip-hammer work. In its manufacture strips of sheet steel are used, one side being rolled thin to form the back, which is done by an ordinary beading machine. The back is turned over and the welding done (the back being hollow except at the ends) by drop-forging in dies of the required shape. The required curve is given to the scythe by a single operation in a machine designed for the purpose. By the old method the curve is reached by a number of distinct forgings. The point is stiffened by inserting a piece of iron into the back of the point; the tang is also of iron. The distinctive claims made for the tubular-blade scythe are: that it costs less to manufacture; that it is lighter, and at the same time stronger, on account of the substitution of the tubular or hollow back for the ordinary bead; and that, for the same reason, it makes its way easier through grass, and does not lodge sand and dirt.

The Watch.

BY F. G. WOODWARD.

One would not suppose at this day that the watch could be susceptible of much improvement considering its antiquity, its world-wide distribution and utility, and the vast amount of inventive thought and refinement that have been bestowed upon it. Many years ago the "patent lever" escapement was regarded as the "*ne plus*" in this line of improvement. Some of the first watches of this class worked with a rack and pinion, the rack upon one end of the lever, the pinion upon the staff of the balance, but the "rack and pinions" were short lived, and were soon superseded by the present detached idea. The "chain and fusee" were long considered indispensable to an accurate "timer." Those who now possess an old "English lever" doubtless prize it as a valuable keepsake for its substantial workmanship and accurate movement.

I have one—always correct in its action, frugal as to repairs, it does not seem to be the least impaired after a run of about fifty years. Experience finally removed the chain and fusee some time ago as superfluities, and gave us the "Howard," the "Waltham," the "Elgin," and others of like excellent repute. But this is not the end of the string. Some genius has lopped off about half the remaining parts of the watch, and given a new "stem winder." Whether it is an improvement or not time will disclose, if money and industry will do it. The fact that the inventor readily found enterprising business men willing to fully secure it by home and foreign patents, and enter extensively into its manufacture, indicates that the watch possesses some merit. In this watch the whole time system, including minute hand, regulator, and plates, revolves bodily and hourly about a common axis in the center of the case and dial, the hour hand being driven by a socket gear on the central staff; the balance and scape wheels are driven by a fixed central gear. The mainspring is several times the length of that of an ordinary watch, and is fixed at one end to the back of the main winding gear. The diameter of this gear nearly fills the back of the case, and the winding pinion on the inner end of the crown shaft is proportionately large and substantial. The reader will note the durable "look" of this combinationl. Experts in horology, and others, who are interested in this class of fine mechanism will doubtless see something in this little time meter which will vex their criticisms.

One Dollar Patents.

The New York *Herald* says there has been presented to the President and Cabinet a plan for issuing dollar patent rights the same as dollar copyrights, that is, on receipt by the Government of a fee of one dollar, together with a description of the invention, either with or without a drawing.

It is suggested that as not more than one in two hundred patents is ever introduced into general use, under the present plan, the one hundred and ninety-nine generally poor inventors will have lost oyly $1 each, while if it is introduced and becomes valuable and is claimed by several inventors, as is always the case even under the present costly examination and agents, the rightful owner is to be determined by the courts as now. Whatever may be the result of the scheme as concerns poor inventions, it would not be likely to work well with good ones. It would doubtless prove a bonanza for the lawyers.

Doubling the speed of a fan-blower, doubles the quantity of air delivered. The pressure is increased fourfold, and the power required to drive the blower is eight times as great.

Danger of Excessive Tensile Strength in Steel Boiler Plates.

BY WM. KENT.

Mr. W. L. Clements' article on the manipulation of steel in the boiler of the steam barge B. W. Arnold, in your issue dated December 5th, is interesting, in showing the danger likely to arise from improper manipulation of steel, but it does not state, as it should, that the steel was of improper quality for boilers. Mr. Clements, in fact, gives the impression that the steel was of good quality in saying "the ductility and tensile strength show a good grade of steel, having a mean tensile strength of 67,971 pounds," yet in another part of his article he quotes the rule of "Lloyd's Register," that steel for boilers should have not more than thirty tons tensile strength per square inch, and the fact that the surveyors of Lloyd's consider it unsafe to use steel above thirty tons per square inch. By Lloyd's rule, therefore, this steel would have been rejected. By the rule which has been in use by the Pennsylvania Railroad Company for several years (steel for boilers must have not less than 55,000 nor more than 65,000 pounds per square inch), it would also be rejected. Every one of the eleven tests given by Mr. Clements falls outside of this rule. He is also in error in stating that "steel for boiler-making purposes should contain from one-quarter to one-third per cent. of carbon." Steel containing as much as one-quarter per cent. of carbon is unsafe for boilers. The practice of all the best American steel boiler-plate manufacturers is to keep the carbon below two-tenths of one per cent.

It is stated in the article that "in the Arnold's boiler were used steel plates stamped by a reputable steel-maker, coupons all tested by the local boiler inspector, and in every requirement of law were found to be satisfactory." The stamping of the plates by a reputable steel-maker probably relieves the boiler-maker from responsibility for using steel of improper quality for the purpose, and the testing of the coupons by the local inspector, and their satisfying the requirements of law, probably exonerates the maker of the steel.

The fault lies with the law passed by Congress for the guidance of the supervising inspectors of marine boilers. For many years this law has especially favored the use of just such steel as was put into the Arnold's boiler, in that it allows a higher pressure to be carried the higher the tensile strength stamped on the steel, and in that it does not specify a maximum tensile strength, over which all steel should be rejected. There is thus a constant temptation to boiler users to demand steel of such high tensile strength that it approaches a dangerous limit.

As it is to no one's financial interest to have the law amended, it will probably remain on the statute book for some years to come; but the AMERICAN MACHINIST may do a good work in educating boiler-makers and users that there is danger in the use of steel of high tensile strength, and that safety requires that we should observe something more than the mere legal requirements.

Umbrella and Strap Friction-Clutches.

The clutches shown on this and the opposite page are made by the Dickson Manufacturing Company, of Scranton, Pa. In the umbrella clutch, the main driving shaft (the end of which is shown projecting through the pedestal) carries with it by means of feathers, the expansible part of the clutch, which presses blocks of wood against the outside rim, and thus causes this rim to revolve, which it would not otherwise do, as it and the pinion shown in the illustration, are fast to a sleeve through which it runs, and independently revolves the driving shaft.

The pinion works through a spur gear, which may be on the shaft of a hoisting drum or other piece of machinery. The groove (lined with wood) on the outer rim, is made for the reception of a steel or iron brake strap, which can hold this part of the clutch, and therefore the hoisting drum, in any position when the clutch is not in gear. It will be seen from this description, that although the driving shaft is constantly revolving, the drum can operate or not, and is always under control by means of the strap brake, which is sufficiently powerful to hold the drum and its load in any position. The clutch is operated by a hand-wheel and screw, as shown, or, in cases requiring great power, by a lever working a toggle joint.

In the strap friction-clutch, the driving and driven shafts are let into each other in order to keep their axes coincident, and on the driving shaft is keyed the "clutch center," which is provided with a groove for the reception of wooden blocks against which the strap creating the friction is pressed. This strap is attached to the "clutch disk," which is keyed to the driven shaft. When the clutch is to be put into action, the non-driving end of the strap is pulled. This is done by means of a small crank arm with which the end of the strap is connected. The force necessary to tighten the strap is small. The shaft of the small crank passes through the disk, and terminates as shown in the engraving.

The operating mechanism illustrated, permits many modifications. For the larger sizes, it may be advisable to operate the clutch by hydraulic power, and this has been done to complete satisfaction in many cases.

Turning Steel-Tired Wheels.

We take the following from the advance sheets of a treatise on the above named subject by the Niles Tool Works, of Hamilton, Ohio.

The car wheel may be viewed as a thing by itself independent of its axle, or it may be looked upon as a thing fast upon its axle.

The first question to consider is: Shall we true up old wheels while they are on their axles, or shall we true them up while they are off their axles? There are two elements involved in this question: first—economy; second—accuracy. If an old wheel is already on its axle, and its future place is on that axle, it costs money to take the wheel off, and it costs money to put it on again. On the score of economy it would be required that the operation of truing the wheel when it is off its axle, should present enough money gain to pay the expense of taking the wheel off and putting it on again. We may dismiss this matter with a statement that no method is now known for turning wheels when they are off their axles which possesses the money-saving quality to any such degree as will compensate for the expense of removal and replacement. On the score of economy, therefore, we should deal with the wheels while they are on their axles. This is on the presumption that the wheels are already on the axles, where they are wanted for future use. Unfortunately the economy of labor, required in the fitting of wheels and axles does not guarantee a perfection of fitting, and it is the experience of many, that if a car wheel is well fitted upon its axle, it is best to let it remain. A good fit will be none the better after a seond forcing, and a poor fit is found incapable of being properly forced a second time. The character of the fitting surface has much to do with this.

If the wheel seat be roughly turned with a coarse feed, it will be found that the eye of the wheel, during the forcing process, has sheared and smoothed down the circumferential rings or threads to a certain extent, leaving an accurate fit upon the tops of the threads. This does not produce a full surface fit, but if the force of the contact is sufficient, the fit may answer for all practical purposes. But upon the second forcing there is a further drawing down of these threads and then we have, in case the same wheel is used, a practical surface fit under a much less forcible contact. If a wheel be forced off and on such a surface several times, the fit will be found entirely loose. If, however, the wheel-seat and the wheel-bore have smooth surfaces, the case is different, as the area of the surface in contact is complete, and there are no threads to be stripped by successive forcings. In view of the general character of wheel fits, we may safely say that on the score of accuracy it is advisable to leave the wheel on the axle until some other motive than the truing of the wheel suggests its removal.

Every lathesman knows that it is a very difficult operation to chuck a piece that has been turned outside, so as to bore the hole true. As difficult as this operation is, he knows that it is much more difficult, and often impossible, to chuck a piece which has been bored so as to turn it true with the bore. This may be illustrated by an ordinary pulley. If a pulley has been turned, it may be put into a chuck and, after much careful labor, properly centered, and the hole bored sufficiently true for all ordinary purposes. But if the hole has been bored in the pulley, no lathesman can chuck the job true enough to permit the outside to be turned true with the bore. The difference in the two operations may be explained by saying that in the first case the finished surface is on the outside where we can see it, and watch and test it, until it runs perfectly true at every part, while in the latter case the finished surface is inside, and where we cannot get at it so as to apply any accurate tests as to its running.

It may be laid down as a machine shop axiom, never to attempt to accurately chuck a job by its bore if its bore is small. This axiom may apply to old car-wheels. If a car-wheel has been bored, it cannot be put in a chuck true with that bore; therefore, no simple chucking operation is available in accurately truing up the treads of old car-wheels.

The machine shop axiom above noted, leads to the following axioms which govern every-day practice in every machine-shop in the land:

1. If a job has been turned outside, it may be put into a chuck and bored accurately, though the process requires an extreme degree of skill and should in all possible cases be avoided by making the boring of the job the first step.

2. If a job has been bored it may at any time be turned upon a true mandrel.

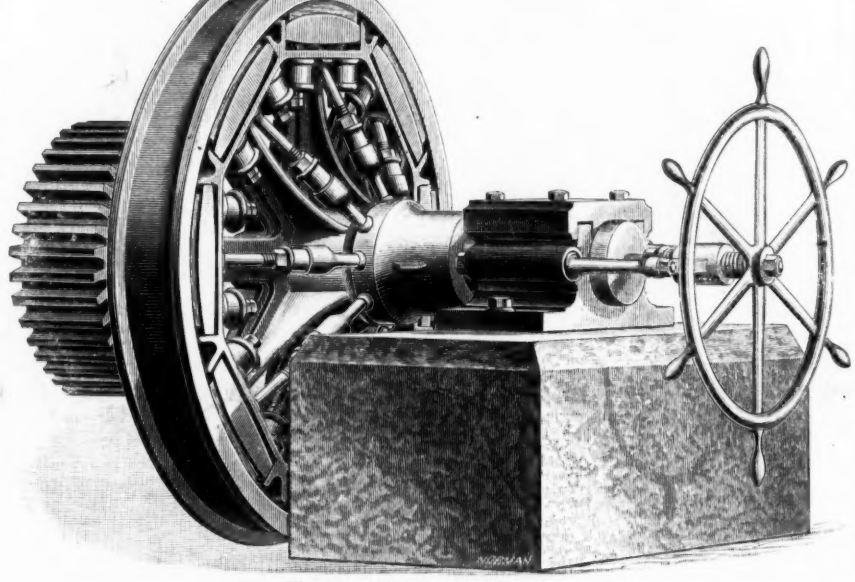
3. Work which is to be both turned and bored, must be bored first and then turned upon a mandrel, if accuracy and economy are sought for.

These axioms apply with full force to old car-wheels.

If they are to be truly turned while they are off their axles, they must be put upon a mandrel. If they are on an axle they are already on a capital mandrel; then why take them off? The old axle being in satisfactory shape, every requirement of accuracy and economy suggests that the wheels should be turned while they are upon their axles.

Steel from iron ore in two hours, is the result of recent experiments in Pittsburgh, Pa., according to the Pittsburgh *Commercial Gazette*.

The Baltimore and Ohio Railroad will establish a Technological School at Mount Clare, Baltimore, for the higher instruction of the young men in their employ. The expense is to be borne by the company. The students agree to serve the company for three years at a fair salary.



UMBRELLA FRICTION-CLUTCH.

Prices of Iron and Steel.

The course of prices for iron and steel has, says the Secretary of the American Iron and Steel Association, been steadily upward for the past three months. The price of pig iron has advanced from $17.85 in August, to $18 25 in November; steel rails from $27.50 in August, to $33. in November; bar iron from $38.08 in August, to $39.20 in November, and cut nails from $2.15 in August, to $2.52 in November.

Running Steam Engines in Texas.

We have received from a correspondent in a Texas town the following doleful account of the manner in which a large number of engines are run in that locality:

This is a nice country to my eye, and a good place for men to come to, who thoroughly understand the principle of the steam engine. There are more engines in this country than I ever saw any place, and men who understand general repairs, and stand ready to guarantee their work, will find plenty to do, for many of the engines are in terrible shape and in the worst of hands. The only wonder is how the boilers stand it. An old two-flue boiler went out last week near Hubbard City, and killed a team and two men. A man that was running another gin near there, told me that, as near as he could find out, that boiler had not been cleaned in a year. But they claimed that it was cleaned before the season started, which was the last of July or first of August. The explosion blew some of the boiler a long distance, and some of it they have never found. I saw one man who had his safety-valve weight on the end of the lever, and would judge it would hold at least 100 pounds, and an old 2¼" globe valve with about 10" of pipe attached, hung on the end with it. [illegible]ng from several others of the same m[illegible]out other sizes, that I have figured up, he must have had it weighted between 150 and 170 pounds, and the iron was shell. I asked him what that was on there for, and he said when he had pretty good pressure on, that thing leaked. The gauge was of the cheap diaphragm pattern that is always off, and I advised him to take off a wheelbarrow load of old iron from his lever, but he said if he did, it leaked. I told him it was his head, and the boiler for it, and went away. There are chances in Texas for good men, but there are enough of the other kind here to furnish the rest of the country.

The Crystallization of Wrought Iron.

Professor Thomas Egleston, of New York City, said, in discussing a paper bearing the above title, read at the Boston meeting of the Mechanical Engineers:

"We are very apt to think of iron and steel as a homogeneous material. It is however, anything but homogeneous. If it is built up by welding, it is supposed you have a union by interpenetration. I found, when I was in the employ of the Government, that in welded surfaces there would be large spaces where there was no interpenetration, and in other cases nothing but juxtaposition. I had prepared a series of steels that were made by welding 24 ingots together. At the end of the time they were reduced to one-fourth of their size, and yet every individual ingot was perfectly distinct. There is another want of homogeneity, and that is, blow-holes. If a blow-hole comes to the surface, it eventually propagates itself through, as a crack. I found, also, that whenever iron, that was supposed to be more or less homogeneous, was submitted to shock, there was a tendency in the materials to undergo crystallization. The crystal faces in this specimen have become large, and the blow-holes coming to the surface, have resulted in a crack. In most of the fractures caused by shock, the fracture is produced by crystallization, owing to the combination of the carbon. This tendency can be counteracted by heat or rest."

John T. Hawkins, of Taunton, Mass., gave an account of an experiment on a round bar that had been broken with a sledge. In some places it appeared wholly fibrous, in others almost wholly crystalline. This, he thought, would go to show that the test given by Prof. Thurston would not be reliable, because, from the same bar broken under the same conditions, you would find different results and different appearances.

W. F. Durfee, of Bridgeport, Conn., said that the way in which wrought iron is constituted does not seem to be well understood, and the difference of the structure from homogeneous material is not fully comprehended. He then described, in an interesting manner, the process of making wrought iron. He thought the fracture in the piece of hammer submitted to the society, might be caused by placing pieces to be hammered on one side or the other, and thus bring the pressure on one part of the hammer, and a straining apart, on the other side.

Richard P. C. Sanderson, of Roanoke, Va., said he had made some experiments to determine the crystalline nature of iron, and he found, invariably at the point where the blow struck the axle, a mass of crystalline iron.

President Holloway said that this question involved others of great importance. One was the influence exercised upon steel by being hammered. It was important, because some of our largest structures are now made of steel ingots, and are hammered. Personally, he was inclined to think we had had no instances in this country where a first-class steel casting had been benefited in a large structure by being afterwards hammered. He also called attention to an opinion of his, that every blow struck on a steel bar seemed to move the outside of it alone, no matter whether it was a large bar or a small one.

Prof. Egleston said there were two ways of getting over the difficulty suggested: by having no center to your steel, or not to hammer it. Hammering, said he, is the worst thing you can do to a large mass of steel, particularly when the inside and outside are not of the same temperature.

Mr. Durfee called attention to the fact that if a large ingot is put in a furnace that is too highly heated, and the temperature on the outside is suddenly raised, that ingot pulls itself apart on the outside, and no amount of hammering would restore the interior homogeneity.

William Kent, of New York City, gave a corroborative instance of this, and Mr. Egleston said that such holes would never close. Mr. Durfee said these fractures, when discovered, were often taken for blow-holes.

Mr. Durfee opened the discussion of the increase of strength in metals, due to drawing them, in manipulating them. "I have no doubt at all," said he, "that the increase of tensile strength is caused in the case of iron, by the reduction of the thickness of the film of cinder which separated the particles of iron from each other, so that the force of cohesion has less space to act through."

President Holloway said it was well known that the refinement of wrought iron increased its tensile strength.

W. T. Nicholson said that steel in small areas might be hammered in such a way as to become so crystalline as to break entirely.

Prof. John E. Sweet, of Syracuse, N. Y., told of an instance where hammering increased the strength of steel every time it was hammered. He thought that if the hammers were large enough, the ingots would not cup at the end, as it was claimed by the president they would.

Mr. Hill said that they made ingots in his factory hammered under a steam hammer, and the ends always rounded out.

J. Wendell Cole, of Columbus, Ohio, thought hammering made steel finer and tougher.

George R. Stetson, of New Bedford, Mass., said there was one class of men who would not be convinced that hammering granulates iron. They were the old-fashioned hammer-smiths.

Oberlin Smith, of Bridgeton, N. J., thought it ought to be considered whether these troubles would occur in large ingots if the hammers were as large and heavy in proportion as the hammers which pounded out small tools.

Mr. Durfee said he thought the idea of the crystallization of iron as the result of prolonged use, was a mistake altogether. The crystals, he thought, running parallel to the axis of the bar and separated by a film of cinder, constitute the fibers of the iron, but there is a transverse separation of each crystal from this line just as there is longitudinally. After this bar or bolt has been shaken up enough, some point or some cross-section may have a slightly thicker film of cinder between the particles of iron, and the cohesion is destroyed.

The electric light has been successfully applied at Woolwich, England, to photographing the interior of cannon. Such pictures are expected to reveal the presence of flaws.

Frank B. Merrill, of the new water company, Syracuse, N. Y., has assured the Trades Assembly Committee that he will not engage foreign labor while there are laborers to be had at home, and that he will pay regular wages. It is thought nearly 1,000 men in that city will want work.

Cleaning Silver.

In the course of the discussion on Mr. Diamond's recent address on Drop Forgings before the Polytechnic Association of the American Institute, S. L. Marsden, of Ansonia, Conn., said: "If you want to clean silver, take one pound of cyanide of potassium to one gallon of water. Put it on the stove and immerse the silver. The silver will come out as beautiful as if fresh from the factory, and as good as new. Thorough washing in clear water is required before the silver is used, as cyanide of potassium is a deadly poison. Great care must be taken in handling or using it for the above or any other purpose.

Discussion at the Philadelphia Engineers' Club.

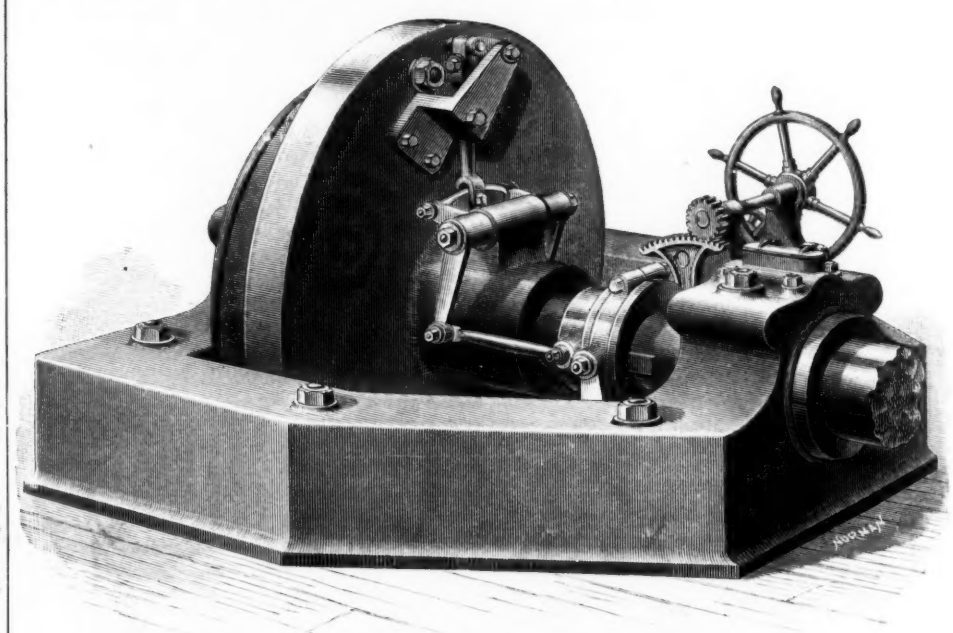
At a recent session of the Philadelphia Engineers' Club, a paper by W. S. Church, was read, describing some of the methods used in excavating the new Croton aqueduct tunnel:

"A most careful system of measuring and recording just what is excavated, is being carried out. A vertical dial, which the boys call 'The Sun Flower,' is set up every 10 feet, and oftener if necessary, and radial measurements taken to all the inequalities of the section; these measures are plotted on the diagrams, and the areas estimated with the planimeter." A discussion followed upon the paper of James Christie upon the "Adaptation of Steel to Structural Work." Thomas M. Cleemann thought the use of steel instead of iron, by engineers, was dependent principally on the manufacturers producing a perfectly uniform and reliable product, which at present they do not seem to do. He thought that the advantage of using a cast metal was in favor of steel, by which struts could be made of a hollow circular section, requiring least material, and the punching of holes for fastening pieces together by riveting, which especially weakens steel of a high grade, could be dispensed with. James Christie said in reply, that it was very improbable that struts would ever again be made directly from castings. Aside from the difficulty of maintaining a uniform thickness of metal, the cost of construction would be greater than by the present method of building up rolled material. Prof. Wm. H. Burr said the steel question presents itself to engineers under two entirely different aspects. The first involves the character of the metal *per se;* and the second is based upon the consideration of the influence of this metal on structural design. In the first place, although improvements in the uniformity of production can yet be made, steel makers, by either the Bessemer or open-hearth processes, are ready to work under any physical specifications effecting uniformity, that may be demanded by the best engineering practice of the present time; and it may be safely asserted that increased uniformity will keep pace with any demand.

Don't trust the indicator card until you know who took it.

The people of Stroudsburg, Pa., have evolved a plan of their own, as an inducement to manufacturers to locate in their town. They offer to lend a New Jersey firm $20,000 at 5 per cent. interest as such inducement.

Peter Donahue, who recently died in California, once worked in a Paterson (N. J.) machine shop. He went to California in 1849. He built a railroad 150 miles long at his own expense, and started the first iron works in San Francisco.



STRAP FRICTION-CLUTCH.

Rating of Steam Boilers by Horse-Power for Commercial Purposes.

EXTRACTS FROM A PAPER READ BEFORE THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

BY PROFESSORS W. P. TROWBRIDGE AND C. B. RICHARDS.

The use of the term horse-power to designate the capacity of a boiler for making steam, has become so far universal, at least in this country, that it is employed at once to furnish in a general way, not only a basis for estimating the first cost, but also a measure of the performance of a boiler when in use.

The incongruity of the expression has, however, become more apparent as the use of boilers for other purposes than power has been extended, and for which purposes they are still sold by the horse-power, and it is becoming more important every year that the true significance of this unit as applied to boilers should, if practicable, be properly defined.

The committee on boiler tests in their very able report, recently submitted to the society, state that "what is needed is a standard unit of boiler power which may be used commercially in rating boilers, and in *specifications* presenting the power to be demanded by the purchaser and guaranteed by the vender."

If the unit of boiler power is to have a fixed, definite, and universally acceptable meaning, it also must be referred in its elements to standard or fixed conditions.

The essential elements or simple units, which must compose the complex unit of commercial boiler power are: 1st, a certain weight of water evaporated in a given time; 2d, a unit of evaporation as determined by the temperatures at which the water is supplied and evaporated; and 3d, the quantity of fuel required to evaporate the given weight under fixed or specified conditions.

If either of these elementary units is left indefinite the whole unit will be indefinite. Let us consider them separately.

I. The weight chosen must be a pound, or the multiple of a pound.

II. The quantity of heat required to evaporate a given weight will be established when a "unit of evaporation" or the quantity of heat required to evaporate one pound is chosen. This requires that the temperature of the feed water, and the temperature of evaporation, shall be taken into account. It is a matter of mere convenience or expediency whether the old and well-established custom of assuming both these temperatures at 212° Fahr. shall be departed from and new temperatures selected.

The number of pounds of water, or the weight of water, which shall enter the unit of boiler power, has not been fixed either by statute or universal custom, while the third element is also one which has not been fixed.

The consideration of fuel consumption is in our opinion, a vital point. Upon it depends entirely whether it is possible for this Society to suggest or propose a unit of boiler power so definite that, used as a basis of agreement between buyer and seller, both can be fully protected.

The proportion of the whole heat so transferred per pound of coal, depends on several independent circumstances: to wit, the quality of the coal, the rate of combustion or draft, the management of the fires, and the amount of heating surface exposed to the action of the heated gases and to the radiation from the incandescent fuel. The quality of the coal and the management of the fires are under the control of the purchaser.

The quantity of heating surface, and the proportion of the heating surface to the grate surface, must almost necessarily be fixed when the boiler is made, and when once fixed are usually invariable, but the draft is a variable quantity. Here then is one of the principal points where the buyer and seller should be furnished with some common ground to stand upon. They cannot refer to universal usage or common practice. An "average" height of chimney or rate of combustion is too indefinite. They should both understand what rate of combustion is to be adopted when the boiler is to develop the power for which it is guaranteed—a certain number of horse-powers.

The capacity of a given boiler for making steam, the grate and heating surfaces being fixed, depends directly on the rapidity of the combustion or the quantity of fuel burned in a given time, the capacity increasing as the rate of combustion increases, but with a diminishing rate of increase.

This diminishing rate of increase in the power of the boiler arises, as is well known, from the fact that although the heat evolved by the combustion of one pound of fuel is the same whether the combustion be slow or rapid, yet the proportion of this heat, which is transferred to the water in a given time, depends on the laws of transfer of heat through the metallic plates, a greater proportion of heat being thus transferred with slow than with rapid combustion; a greater proportion also being transferred the greater the amount of heating surface in proportion to the weight of fuel burned in a unit of time.

It is therefore necessary in establishing a unit of boiler power, that the rate of combustion as a limiting condition shall be fixed, otherwise this unit will be an indeterminate quantity.

By referring the rate of combustion to the heating surface, this object is not only attained, but a reasonably uniform standard for the economy of evaporation—a most important consideration in connection with the market value of boilers—is secured.

This idea of referring the rate of combustion to the heating surface was suggested by Rankine, and also by General Morin, and if it be impossible to introduce the rate of combustion as an element of the unit under consideration, it seems to us that it would not be advisable for this association to commit itself to any definition whatever, but rather to discourage the use of the expression horse-power, as applied to boilers.

We believe, however, that the subject is well worthy of further consideration by the Society, not only with the object of giving, as far as possible, uniformity to the rating of boilers throughout the country, but for the purpose of affording, in cases of actual dispute or litigation, some common ground for engineers and experts to stand upon in their determinations of the commercial rating of boilers.

It is not the object of this paper to discuss in detail the questions which must be considered in establishing a proper unit of boiler power; nor even to suggest or recommend any definite formula for such a unit; but

rather to urge the subject upon the Society as *one which should be separated entirley from that of boiler tests;* and which, since it has come before the Society for discussion and action, should be treated with the care which its importance seems to deserve.

When the importance of the steam boiler is taken into account, and the many issues which may depend on a correct understanding of the term "horse-power" as applied to it are considered, it seems to us that the American Society of Mechanical Engineers may do the public a real and substantial service by making this subject one of special consideration and action.

Purchasers of boilers, who are chiefly interested, have no other resources for reliable authority or information than the deliberate decisions of an engineering society like this, which in its organization and membership is in every way competent, and the only public authority to which such questions can properly be referred.

In conclusion, we desire to state that we consider that the chief object to be attained in agitating this subject, is the adoption of a unit so clearly and precisely defined as to remove, as far as possible, all uncertainties as to the conditions which form the basis of a purchase and sale, and under which precise conditions an engineer or expert must undertake a test in case of dispute.

The unit of boiler power which shall meet public expectation should evidently be one so defined that no two experts in determining the power of a boiler could substantially or materially disagree in their determinations.

DISCUSSION.

Geo. H. Babcock objected to the effort to do away with the horse-power unit which had been established by long usage and confirmed by judicial decisions. He reviewed the definitions of horse-power given by Watt, and the other units which Watt used, and endeavored to show the absurdity of introducing this new element of fuel consumption in calculating the power of boilers. "We are told," said he, "that a body may have three dimensions, but we never heard of four." The horse-power of boilers, as defined by the committee on boiler tests, has the equivalent of static force in the water evaporated; of weight, in the increased volume; and of time, in the period specified. In the matter of horse-power, the question of fuel is a question full of difficulties; and it would be more convenient and desirable, if this element is to be expressed, that it should be expressed in dollars and cents, instead of pounds of coal. Then we might go further and establish a standard cost outright of the boiler itself. The poor bewildered purchaser might thank this Society for doing so; the question is, What shall be considered a standard of boiler horse-power? There is no more reason why a man should be his own engineer than his own lawyer or doctor. The plan proposed by the committee on boiler tests comprises a standard pressure, a standard weight, and a standard time.

William Kent expressed regret that Professors Trowbridge and Richards were not satisfied with the view taken by the Society, and endeavored to keep open the agitation. He believed the standard adopted by the centennial committee of judges is not only accurate but the best that is attainable under present conditions. He cited a number of cases in which he said: "The fuel consumption had no proper place, and would only lead to vexatious complications if it were brought in." In many cases, he pointed out, the fuel consumption is entirely unimportant, as refuse or very cheap fuel is used.

Prof. Thurston said, "that when the committee came to attack the subject, it was necessary for them to find a unit of measure, not of power, by which the boiler should be known, but of the power actually delivered from the boiler. The committee at that time had no business with the measure of the capacity of boilers with a view to determine how they should be sold in the market. There are two distinct things to be considered: First, what shall be the unit by which boiler power shall be measured? second, under what conditions may that unit be applied in order that we may be able to say that a boiler has a certain power or has not a certain power?"

LETTERS FROM PRACTICAL MEN.

Laying out Rivet Holes in Sheet or Boiler Iron.

Editor American Machinist:

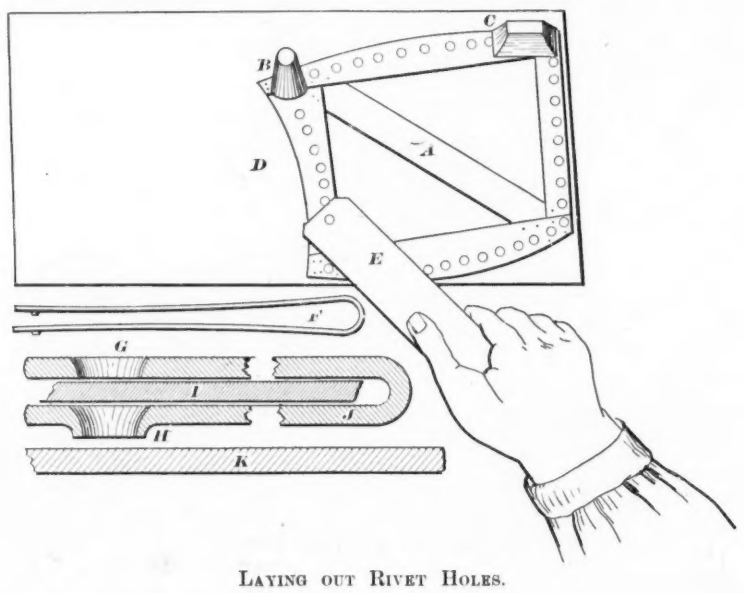
It often happens that a hole is to be patched in some iron tank, boiler, or ship. A template of thin wood is made and fitted in the place to be occupied by the new plate. The holes are marked as desired.

The cut shows a handy marking tool for transferring the hole marks from template to iron plate, as practiced by several ship builders and sheet-iron workers.

A is the template, in position upon the plate *D*, and held by the weights *B* and *C*.

The tool *E* is made of thin steel about 2″ wide. It is formed as shown at *F*, and in the section G, J, H.

At *G* a slight burr is left where the hole is punched, and is filed up sharp to be accurately placed upon the hole marks when



LAYING OUT RIVET HOLES.

they are scratched upon the template.

At *H* a burr is turned down $\frac{1}{4}$″; it is done by careful punching.

When in use the burr *H* is dipped in white lead, the template slightly raised, and the tool clasped upon it as shown at *I* and *E*. It is then pressed down upon the iron *D* or *K*. The white lead upon *H* makes a neat circular mark, whereby the hole may be punched out, or centered and drilled. H. F. J.

Setting Compound Rest.

Editor American Machinist:

The following method of setting a compound rest for turning the tread of car wheels, is slightly different in application, although not in principle, from the method given in the AMERICAN MACHINIST, November 28, by Ralph E. State, for turning a taper hole:

Required to turn $\frac{1}{8}$″ coning, a tread $3\frac{3}{4}$″ wide.

Divide $\frac{1}{8}$″ by $3\frac{3}{4}$″, which equals $\frac{.125}{3.75}$—or .033333 +

The tangent nearest this number is 1° 45″.

Set the rest at 2°, which is very nearly correct. W. G. RICHARDS.

Fillet Composition.

Editor American Machinist:

In 1873, I had charge of the building of a steam pump. To lighten the castings and please the eye, the curves of the draftsman were brought out in all their fancy lines, and to push the work, only the general outlines of the pattern were finished by the pattern-maker, leaving the fillets, screw and brad holes to be filled, and the varnishing to be done by myself.

For fillets, and filling holes, I made the following mixture:

2 lbs. best beeswax, 2 oz. yellow ochre, 1 oz. white lead. Melt the wax, and stir in the ochre and lead gradually, until well mixed.

This mixture may be melted, and run into the corners while hot, or it may be held in the hand until slightly warmed and softened, when it may be pressed into place like ordinary putty.

First, give the pattern a coat of varnish, then apply the mixture, using a hard-wood stick, flat on one side and half round on the other side (or, better still, a steel tool nicely polished) the ends being a true circle, and rounded about the size of the fillet wanted. It may be made double-ended for different sizes. Press the mixture into the place where wanted, by the rounded end of stick, using the back of the stick until the desired effect is produced, then draw or scrape with the flat or face side, inclining it against the pattern on either side to take off the surplus. Wetting the end of the stick from time to time, gives a gloss to the work and frees it better than when dry.

A little patience and practice will give the desired effect, and you will be surprised at the result, and the uses it can be put to.

For fillets, stopping up screw and brad holes, and for building out, to a certain extent, it makes a cheap material, and cannot be beaten. W. H. BUTLER.

Rhinebeck, N. Y.

Venting Difficult Brass Castings—Lead Not Essential to Soundness—Good Arrangement for Furnace Grate.

Editor American Machinist:

In your issue of November 28, Mr. Masters mentions some brass tubes 12″ long and 2″ in diameter with a flange $\frac{1}{2}$″ × $\frac{1}{2}$″ on one end, having a hole 1″ in diameter cored through them. When these castings were poured in a horizontal position, it was found that they would leak under a steam pressure of 60 pounds; when poured in an upright position they were perfectly sound. I do not think the position in which they were poured caused the soundness in one case, or the unsoundness in the other.

We make a brass casting here 18″ long and with diameters of $1\frac{1}{4}$″, $1\frac{1}{2}$″ and 2″ and with a $\frac{5}{8}$″ core clear through. We pour this horizontally and always get a sound casting, but it is due to having a large vent hole ($\frac{3}{16}$″ in diameter) through the whole length of the core, and pouring the metal hot enough to flow freely, and yet not hot enough to cut the sand. At first we lost these castings, because we used too small a vent wire, and they were no better when poured perpendicularly, than when poured horizontally.

We make another casting, more difficult than Mr. Masters' tubes, on account of having only one core bearing. It is 9″ long, 2″ in diameter, and with one end solid; 2″ from the other end there is a flange $4\frac{3}{4}$″ in diameter and $\frac{3}{4}$″ thick. It is cored out $8\frac{1}{2}$″ of its length, the diameter of the core being $1\frac{1}{8}$″ to $1\frac{1}{2}$″, so that, excepting the closed end, it is almost the same as Mr. Masters' tubes. The inside end of the core is held in place by a piece of tinned sheet copper 4″ long, $\frac{3}{4}$″ wide and $\frac{1}{16}$″ thick, made up in the core, and resting in a core print in the lower half of the mould. This casting we pour horizontally, $\frac{3}{16}$″ vent, but use the wire in making the core, and we have never had one leak.

I know, beyond a doubt, that the presence of lead, though very useful, will not insure soundness in brass castings, and also that its absence will not cause unsoundness. Having the moulding sand neither too wet nor too dry, cores well vented and thoroughly dried, metal properly mixed and poured, are the essential conditions for successful brass moulding.

A good arrangement of a grate consists in having two pieces of iron 6″ long, 2″ wide and $\frac{3}{4}$″ thick bolted under the bottom plate of the furnace 6″ apart and extending 2″ inside at the back of the furnace, and in front, resting in a slot in the cross-bar under the furnace, one loose piece of iron of the same width and thickness as the others, but long enough to extend 2″ inside and 2″ outside of furnace, and with a 1″ hole near the outer end. If the grate be of one piece, and its diameter $1\frac{1}{2}$″ shorter than that of the furnace, it can be readily put in from above or below, and will rest securely on these three pieces of iron. To clean the furnace; pry the front piece out 2″, and the grate will drop. When the furnace is cleaned, push the front piece back to its place and with the tongs lift the grate edgewise through the furnace, and set it in its place.

Lima, Ohio. JOSEPH WHITE.

Brass Melting, Brass Furnaces and Brass Mixing.

Editor American Machinist:

I have found much to interest me in the articles on moulding, but never more so than now when you are having a discussion directly in my line, which is brass moulding.

The furnace illustrated by friend Masters, is, I have no doubt, a good one, but I think it is capable of several improvements. In the first place, I would sink the furnace low enough to allow the top of it to be flush with the floor, or, at the most, not more than 4″ above it; then the men when taking out the crucible would not have to lift so high, and would not be so likely to make a misstep which might be the cause of maiming them for life. The shell of the furnace, I would have made out of $\frac{1}{8}$ inch sheet iron in the form of a drum and would line it with bricks made in sections, 4 of which make a complete circle.

The drum should be made so that the bricks will fit without wedging, and spaces can be filled with fire-clay mixed thin with water.

I cannot agree with Mr. Ward that loose bars are the best for grates. When I took charge of the foundry where I now work, there were six furnaces rigged up just as Mr. Ward says his are. I tried them for a while, and then I made up my mind to try something else. Not being able to take the furnaces down and rebuild them, I made a pattern for a grate, and had it cast in one piece. I put a strip on the back side of the grate, to rest on the bar at the back of the furnace, and made a rest for the front by bending a piece of iron bar at right angles, and making it long enough that one side of it came up against the outside of the furnace and the other went through a hole and under the front of the grate. Now, when I want to dump my fires, all I have to do is to pull out my hooks, and the whole bottom falls out.

The best way is to have the grate hinged to the bottom plate of the furnace which can be done by casting two hooks on the under side of the bottom plate, and having two lugs on the grate to fit into them; also have a piece about $1\frac{1}{4}$″ square and 6″ long, projecting from the front of the grate.

Cast a hook something like a latch, and bolt it to the bottom plate of the furnace (which I would have at least one inch thick) then hang the grate on the two hooks under back of bottom plate, raise the front, and the grate will drop into place of its own accord. I do not think it is necessary in firing up a crucible, to have the coal any higher than the top of the same.

If time were no object, the suggestions by Mr. Ward, to put a brick in the flue to

check the draft, and hold the zinc in the tongs near the surface of the molten copper until it began to melt, might be good, but if I saw a man doing it, I would be very likely to ask him what he was about.

I believe that the quicker you can get your metal melted and out of the furnace, the less chance there is for waste by oxidation.

The compositions given by Mr. Masters are very good, but I think that bronze with 18 lbs. tin to 80 lbs. copper would be too brittle for most uses, and brass with only 20 lbs. zinc to 80 lbs. copper would be a little too good stock for ordinary use.

RICHARD M. WHITTAKER.

Stamford, Conn.

A New Form of Steam Calorimeter.

BY GEO. H. BARRUS, BOSTON, MASS.

A PAPER READ BEFORE THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

The calorimeters ordinarily used for measuring the dryness of steam operate in an indirect manner. They first determine how much heat is contained in the sample tested. The condition of the steam with respect to dryness is then shown by comparison of the result with the quantity of heat given by the authorities for dry saturated steam. The sample contains moisture in proportion as the result is less than the authorized standard. It contains what is termed superheat, in proportion as the result is greater than the standard.

Suppose the steam has a pressure of 80 lbs. per square inch above the atmosphere: the total heat given in the tables for this pressure is 1212.6 B. t. u. above 0 Fahr. If the calorimeter test yields, for example, 1190 B. t. u., it falls short of the standard 22.6 B. t. u., which is an indication that the steam contains

$$\frac{22.6}{885.7}=2.5$$

per cent. of moisture. If the test yields, say, 1225 B. t. u., it gives an excess over the standard of 12.4 B. t. u., which is an indication that the steam is superheated.

$$\frac{12.4}{.475}=26.1 \text{ degrees.}$$

Calorimeters which work on this principle do not give accurate indications of the amount of moisture in steam, unless thermometers and scales are employed which are sensitive and which register minute changes, and unless extreme care is used in the manipulation of the apparatus. In the case of the *barrel* calorimeter, the one commonly used, supposing the range of temperature to be 50 degrees Fahr., and the weight of steam used for a test 20 pounds, an error of half a degree in the observations of the thermometers, or an error of one-fifth of a pound in the observations of the weight of water in the barrel, causes an error of one per cent. in the result. A larger error than this might ensue, if the observation of each extreme was erroneous, and all the errors acted in the same final direction. Unusually close work is more important than would first appear, for the reason that the moisture in steam of ordinary dryness, does not often exceed 3 per cent., and a small error becomes large by comparison.

Calorimeters of the continuous type are more accurate in this respect, for they deal with larger quantities of steam and water, and a greater number of observations for a given test. But they require equally careful manipulation.

The new form of calorimeter presented in this paper is offered because it so far reduces the errors referred to that they become almost inappreciable, and it greatly simplifies the operation of making an accurate test. In order to use it, it is simply necessary to observe thermometers which show many degrees change of temperature for a change of one per cent. of moisture. It should be said at the outset that it is intended to be used only for testing moist steam.

Unlike the calorimeters referred to, the new apparatus operates directly upon the moisture contained in the sample of steam tested. It evaporates the moisture, and determines its amount by measuring the amount of heat required for this purpose. The evaporating agent is a current of superheated steam, and it is the superheat of that steam which is utilized to do the work. The determination of the amount of superheat required constitutes the immediate object in view, and this is attained by observing the temperature of the superheated steam before and after its use. When the quantity of superheated steam equals that of the sample tested, the evaporation of one per cent. of moisture reduces the temperature approximately, 18.7 degrees Fahr.* In proportion, then, as the fall of temperature is greater or less than this number of degrees, the amount of moisture sought for is greater or less than one per cent.

It is immaterial what the exact quantity of steam is which is tested, so long as the relation borne to the current of superheated steam remains constant. Weighing is therefore dispensed with altogether, and the desired relation between the quantities is maintained by causing each current of steam to pass through an orifice of fixed size. To obtain equal quantities, which is the relation most to be desired, the two orifices are made of practically the same size and the steam is admitted upon them with a pressure common to both.

The general form of the apparatus is shown in the illustration, Fig. 86.

Two half-inch connections are made with the steam pipe or boiler, one for the attachment of the pipe *H*, which is to convey the moist steam to be tested, and one for the attachment of the pipe *E*, which is to supply the superheater. The moist steam enters and passes through the pipe *H O*, surrounded by the jacket *I J K*. On its exit at *O*, it passes through the thermometer chamber P, and emerges through an orifice at *N*, about $\frac{1}{8}$ of an inch in diameter.

The supply of steam at *E* enters the superheater *G*, which is a $1\frac{1}{2}$-inch pipe, and is there heated by the gas lamps *R*. It then passes through the thermometer chamber *Q*, and enters the jacket *I J K*. The hot steam traverses the length of the jacket, passes through the thermometer chamber *L*, and emerges at the orifice *M*, which, like the one at *N*, is about $\frac{1}{8}$ of an inch in diameter. Each thermometer chamber is provided with an immersed oil cup, containing a thermometer as shown at *L*. The ends of the jacket are provided with insulated stuffing-boxes (not shown in the drawing), through which the inner pipe passes, and this pipe is subdivided into a number of smaller pipes to increase the heating surface. The outside of the apparatus, with the exception of the superheater, is protected with non-conducting covering,

In operating the calorimeter, full pressure is admitted to both pipes, and the jacket steam is heated till the thermometer *C* commences to rise above a normal temperature, a condition which indicates that the moisture is all evaporated from the steam to be tested. As soon as the indications have become constant, the difference between the thermometers *A* and *B* is observed, and the quantity thus obtained is corrected for the amount which *C* has risen above the normal temperature. A still further correction is applied for radiation from the outside of the jacket, which is found by passing steam of the same average temperature through the jacket, without admitting steam to the inner pipe, and observing its fall of temperature. With hair-felt covering, the radiation causes a reduction of from 10 to 15 degrees, varying according to the degree of temperature. The weight of steam used by each pipe when the pressure is 80 pounds, is about 60 pounds per hour.

The result gives the number of degrees of superheat, corresponding to the moisture which has been evaporated. To find the percentage of moisture, this number is divided by the number of superheat degrees, corresponding to one per cent. of moisture, that is, to one per cent of the latent heat at the existing pressure, which, as already noted, is

$$\frac{\text{Latent Heat.}}{47.5}$$

To revert, now, to the matter of the error to which the new calorimeter is liable, a difference in temperature of approximately 18.7 degrees appears when a change of one per cent. occurs in the amount of moisture. If an error, therefore, of 18.7 degrees was made in observing the required difference of temperature, it would affect the result only one per cent. In the case of the barrel calorimeter, an error of 18.7 degrees would affect the result 37.4 per cent.

DISCUSSION.

George H. Babcock, of New York City, said the necessity of something more accurate than we have is very apparent. At the test made at the electrical exhibition, the judges found it necessary to throw out all the tests made by the calorimeters and guess at the results, as they could guess nearer than they could measure. While he felt indebted to Mr. Barrus for the suggestion of a new method, he could suggest several difficulties. It was more difficult, he said, than might be supposed, to get orifices of exactly the same size. A microscopic fleck of dust will seriously affect the results. Then there is a considerable difference in the rate of flow of steam, according to whether it is moist, or dry, or superheated. Whether it will be possible to accurately ascertain the differences, even by a table, so as to make proper allowances, is questionable. Again, this is arranged for steam of one definite amount of moisture—steam which is all alike. We all know that the moisture in steam will vary considerably, that a little difference in the speed of drawing the steam from the boiler will make a little difference in the quantity of moisture, and sometimes even the question of firing will make a difference.

Prof. Gaetano Lanza, of Boston, said that at the Institute of Technology one of the glass calorimeters was in use, and as a rule gave good results. He thought a good deal of trouble was due in many cases to varying pressure.

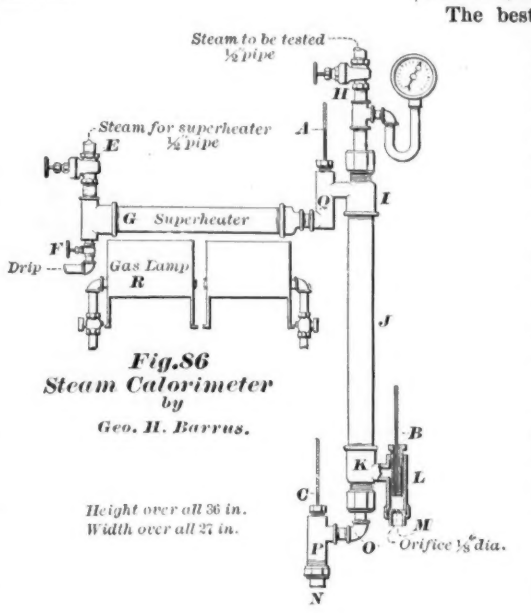


Fig. 86
Steam Calorimeter
by
Geo. H. Barrus.

Prof. Robert H. Thurston, of Ithaca, N. Y., said that fifteen years ago the quality of steam leaving the boiler was not thought of as of any great importance. Up to that time the only man who had given the subject careful and scientific consideration was Hearne. He began his experiments as early as 1865, but up to 1871 there never had been any considerable amount of experimentation. Nobody knew, in stating the work of a steam boiler, whether the results as given for this particular boiler might not be complicated by the difficulty that no one could tell him whether the steam were wet or dry, and if wet to what extent it was wet. Prof. Thurston described at length the method which he took in 1871, as the chairman of a committee of judges, to determine these elements accurately. Some tubes were obtained, and from those tubes was built up a surface condenser. Into that was turned all the steam that the boilers would make, and thus the boilers were tested. The test ran a day in each case. The judges determined as well as they could what was the condition of that steam. "My idea," said the speaker, "was to see by some method—it might be rough, but would be in some degree satisfactory—whether we could rely upon the old tests and could go on without testing the quality of the steam. The result was to show that the old results were fairly satisfactory, but we also found that it was possible to reduce the amount of priming to any extent, and even to produce superheating. It would be entirely impracticable, however, to use this method in ordinary exhibitions, and our next experiment was by the barrel or tank calorimeter. It has been used by a great many engineers and is still in use, but only one or two gentlemen for whose opinions I have great respect, tell me they are getting fairly satisfactory results; and it is necessary to have scales that shall have unusual accuracy." Prof. Thurston then spoke of the difficulty of getting accurate thermometers that would stay accurate. In conclusion, he said he thought the device presented had many advantages for meeting difficulties.

Prof. Wm. A. Rogers, of Cambridge, said that the difficulty in getting exact diameters could be solved, not by any mechanical method, but by examination under a microscope. He thought the difficulty about the thermometer also could be wholly and completely solved. He was himself completing some experiments in Cambridge, with two metal strips which could be immersed in the steam. One of the strips was of steel and the other of aluminum. They are fastened at the end, and a line is drawn across at a given temperature. He finds that they act 15 or 20 times as quickly as the ordinary thermometers and the zero remains unchanged.

* This is the exact quantity for 80 pounds pressure. For other pressures the quantity is obtained by dividing the latent heat by 47.5.

Hydraulic Mining.

The following paragraphs are extracts taken from an address by John B. Hittell, delivered before the Society of California Pioneers, San Francisco, Cal.

The best methods of handling water in shallow and deep placers are entirely Californian. Here most of them were first invented, and all were carried to the highest perfection. The board sluice, known in other lands in ancient times, was re-invented in Nevada county and made far more effective than ever before. Hydraulic washing, the process of using a stream of water under pressure to loosen an alluvial auriferous gravel, first invented in the same county by Edward E. Matteson, was afterwards improved by globular joints to connect the nozzle with the pipe, deflectors to enable one man to turn a nozzle ten inches in caliber under a pressure of 400 feet, internal feathers to keep the stream from twisting and scattering, and many other devices. By the help of Matteson's invention at least $500,000,000 have been added, in California, to the world's stock of gold. Delmar, misinterpreting Pliny, makes the mistake of asserting that hydraulic washing was used in ancient Spain, but Pliny's language does not imply anything beyond the ground sluice, a much inferior process.

By bold experiments the early hydraulic miners ascertained that sheet-iron pipe would bear a much greater pressure of water than the engineering authorities recognized, and that by dipping it in coal tar at a temperature of 400 degrees it could be protected against oxidation for a long time, and its inner surface could be smoothened, so that a swifter current would run through it. The pipes were enlarged and used as inverted siphons to carry water across ravines several miles wide, the greatest pressure being 1,900 feet, equivalent to 770 pounds to the square inch, whereas 200 is high pressure in a steam boiler. By the ingenuity of Joseph Moore and Francis Smith, of San Francisco, these remarkable pipes were supplied with lead-covered joints, hydraulic gates to check or stop the flow, and cocks to let out air at the high points and to let out water at the low points.

The old square wooden stamp has been superseded by the revolving iron stamp, the cylindrical stem of which is lifted by a double-arm cam with a single hub acting on a gib tappet, both cam and tappet having received their present shape from Irving M. Scott, of this city. The simple mortar used before 1849 for all stamps has been differentiated here into three patents—one for gold, another for the dry crushing of silver, and a third for the wet crushing of silver ores.

A Southern genius has invented a water wheel which he expects will "use the same water over and over again." The next invention of this "genius" will probably be running an engine with its own exhaust steam.

Beware of long, crooked suction pipes, when erecting a pump. Bends, returns and angles increase friction very rapidly. Also remember that doubling the diameter of a pipe, increases its capacity four times.

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NEW YORK, DECEMBER 19, 1885.

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Preparing Circulars and Catalogues.

There has been much improvement in the average character of trade circulars and catalogues during the last few years, but there is plenty of room for more improvement. Next to producing an article of merit, it is essential to present it before the public in as favorable a way as possible. Many who succeed well in the former fail in the latter. In preparing a circular or catalogue of machines, the first requisite is to have good engravings to represent them, and this appears to be a stumbling block in numerous instances. We could never understand the economy which leads some men to spare no necessary expense to produce a good machine and then have a cheap caricature made to show it upon paper. The public who do not see the machine, get their ideas regarding it from the print, which is supposed to be a likeness. The best policy is to have the engraving look better, if possible, than the machine. The same principles that apply to the production of a practically perfect machine, apply also to the production of an engraving to bring it to the view of the public.

Accompanying the cut of a machine should be a concise description of its construction and operation, for this is what the buyer wants to know. Instead of this information, we often find a lot of type set up to tell us of the wonderful accuracy with which the parts are fitted together, the care exercised to use none but the very best materials, and the guarantee that it will do more work than any other machine of its kind. Usually when no particulars worth mentioning are given, the conscience of the man preparing the circular seems to be smitten and he concludes thus: "For any further particulars apply to"—himself.

As trade catalogues are being produced in the highest style of typographic art, it becomes a matter of importance to avoid sending out any that are poorly printed. Economy in this direction demands that the printed pages shall show as well, at least, as those of any competitor.

The preparation of a good catalogue usually involves considerable time and expense. It also involves brains. The limit of possibility is great. A complete treatise on a machine embracing not only the details of its construction, but how to do work upon it, is often prepared for the use of customers. Again, valuable tables for mechanics and rules for certain kinds of work, render a catalogue particularly desirable for preservation. Competition in catalogues and circulars is not likely to grow less. It increases with the march of mechanical progress.

It is as much easier to find fault with what others do than it is to do something, as it is easier to ask than answer questions. In mechanical matters there is not much room for the man who can do nothing but object to the course of others. Fault-finding, to some extent, is a negative virtue, but it ought to go along with a good deal that is positive.

It is gratifying to note that it is beginning to enter the heads of those in authority, that the people of the United States are desirous of having something more than an apology for a navy. When the Government is possessed of a respectable navy, there will be some hopes of building up the merchant marine. No objections to expenditures in this direction, if judiciously made, will be raised by any one.

Some inquiries, recently made, lead to the belief that there are proportionately about as many apprentices taken to the machinist's trade now, as ever. Most large manufacturers have a liberal number of apprentices, in which they are undoubtedly wise. The large railroad repair shops also give employment to a fair number, and find it to their advantage to do so. Some of the best-managed railroads in the country depend mainly upon the apprentice plan for keeping the ranks of journeymen mechanics full, and by doing so, have most excellent mechanics.

Fraudulent Situation Brokers.

Those who desire to obtain positions as stationary engineers will do well to avoid the situation brokers, who advertise in the daily papers their ability to obtain steady places and good pay for persons willing to pay them a bonus. Situations that are worth having, are not got in this way, and applicants should understand that they are in great danger of being swindled by trusting such parties with money in advance. In New York city, a license is required in order to keep an intelligence office on this plan, and any person who, without being able to produce such a license, undertakes to secure engineers' places for a fee in this way, is a fraud, and, as such, amenable to the criminal law.

The articles entitled "Examinations for Stationary Engineers," published in the AMERICAN MACHINIST in the issues of April 25th, June 27th, and Aug. 22d, seem to have been very effectual. They have been revised, expanded and re-written, and hardly any technical publication now considers itself "up with the times" unless it has a more or less elaborate catechism for the engineer or fireman.

Heating Shops by Exhaust Steam.

Shop heating is every year becoming more of a problem. Stoves are out of the question—they are expensive and a nuisance. Exhaust steam heating, as usually practiced, requires unavoidable back pressure, and costs more than to heat by direct steam.

Direct, or live steam heating, is at once almost universally condemned as very expensive, when really it is apt to prove a cheaper method of heating than the use of exhaust steam under back pressure.

A system for exhaust steam heating, which is often connected with live or direct steam, for use when the engine is not at work, is not desirable unless entirely under the control of a capable engineer; it proves pernicious when unauthorized persons turn direct steam into the system with the exhaust, causing great loss.

By heating the shop with hot air, and heating the air with exhaust steam, one may get the benefit of what unused heat there is in the exhaust steam without adding a single pound of back pressure.

By putting a surface condenser at any convenient place in the engine room, and forcing air through the condenser instead of water, the air, after being heated, should be conducted to where it is to be used, in the same manner that is now in use in connection with heaters and furnaces.

Navy-Building as a Help to Business.

There is a strong and rapidly growing sentiment throughout the country favorable to the building and equipment of a creditable American navy, such as would be needed for purposes of defence in case of need, and better still, such as, through its existence, would be likely to render its actual employment less necessary.

That the present is a good time to undertake the creation of a substantial navy, there are many reasons for believing.

That active work in navy-building at this time, coming, as it would, at the close of a long period of dull times and, as we hope, at the beginning of a long period of good times, would supply a considerable impetus to business in many lines, there is also reason to believe.

We are all willing to have business helped. If the present building of the new navy, that has been so long needed, will tend to help business, why not build it now, rather than later?

Building a navy, which is not needed, for the purpose merely of spending money, is something that would not be likely to prove popular. But everybody admits that the possession of a suitable navy might, any year, save the country many times its cost in the way of war losses at the hands of even insignificant antagonists.

The only question, therefore, is as to when it shall be built. Now is the time to build it.

Dr. W. St. George Elliott, of London, England, kindly sends us a pamphlet reprint from the proceedings of the Iron and Steel Institute of T. Nordenfelt's paper on "'Mitis' Wrought Iron Castings." We published the paper in full in our June 6, 1885, issue.

We learn from one of our subscribers, who is intimately connected with the sugar interests in Cuba, that the crop this year will be heavier by about 50,000 tons, than the one of last year, and of a better quality generally, with a tendency to an increase of prices.

Census Report on Machine Tools and Wood-working Machinery.

The Government Printing Office at Washington has printed, and the Interior Department, through the Census Office, has just issued, Prof. F. R. Hutton's report to Prof. W. P. Trowbridge, on "Machine Tools and Wood-working Machinery" for the tenth census of the United States. The report is divided into two parts, the first treating of tools for working metals, by compressing shearing, paring, milling and grinding respectively. The second part treats of tools for working wood by "cutting off the fibers," by "shaving the surface," by "combinations of these two," and by "grinding" respectively. The report is a large pamphlet of 294 pages, and describes in orderly succession, the various tools and machines employed in the various processes enumerated in the title. Prof. Hutton's work of arrangement and description bears evident marks of care and skill, appearing to be very creditable.

While heartily commending Prof. Hutton's part of the work, we cannot criticise too strongly, however, the quality of the hundreds of engravings scattered through the volume. In showing the world the line of tools and machines which Brother Jonathan uses, in "whittling" and otherwise working iron and wood, surely the Government should have represented them by engravings worthy of the splendid line of tools it attempts to illustrate. Wood cuts of the best quality would have been none too good, but "photo-engraved" copies of wood cuts have been used instead, with results anything but flattering to the national pride, and more especially in view of the fact that the tenth census dates from nearly five years ago.

Inexcusable Carelessness at the New Aqueduct.

About thirty men have been killed, and two or three times that number permanently disabled since last May in the work of building the new aqueduct for increasing the water supply of New York City. This sacrifice of life is discreditable and inexcusable. The work is being done by contractors, but the city retains the right of supervision over the safety precautions. It is a shame that this should be necessary; it is a disgrace to the city that it is not attended to. If the killing and maiming of horses or other animals was going on to an extent equal to this, we should hear of prompt and effective interference. There is a growing belief that importation of cheap labor is cheapening the estimation in which human life is held; the apathy with which weekly accounts of killing or maiming workmen on the aqueduct is regarded, strengthens this belief.

The argument that this remarkable exhibit of casualties is due to the carelessness of the workmen, is not valid as an apology. It is well known that the class of men, who do the hard work on jobs of this character, are careless in the sense of not understanding the danger of inefficient and trappy devices and arrangements. Contractors do not hire mechanics and engineers for that kind of work, but they should be compelled to protect the lives of those they do hire. It is undoubtedly cheaper for them to hire other

men to take the places of those killed and disabled, than to provide for their safety, and here is where the supervision reserved by the city, should be stringently enforced.

It is said that the city officials do not interfere because, in the event of their doing so, the city might, perhaps, be held pecuniarily responsible. If this is true, it is more than mean; it is cowardly. We hear, occasionally, of conferences of these officials over the subject; in the meantime the killing goes on with regularity, and coroners see that no one is harshly censured.

One Way of Warming a Factory.

Not long since in building a new chimney for boilers, the chimney was built round and thus without corners to retard the draught. No brick core was used, but a cast-iron pipe, cast in sections, was set in for a core, and a space of 6″ left for an air space, open to the air outside the chimney. The air space was closed at top of chimney, 16″ tin piping being laid from the third story of the factory to the air space. Notwithstanding numerous predictions that the draught would be spoiled, the third story and part of the fourth in that factory are now warmed from the air space in the chimney.

We are indebted to the editor of *Wood and Iron*, for a copy of the November issue of that publication, containing a set of answers to fifty questions, by E. D. Davis, of Minneapolis, Minn., during an examination in steam engineering, by C. L. Redfield, known to our readers as a contributor to the AMERICAN MACHINIST.

The answers indicate a practical knowledge of stationary engine running that speaks well for their author. Considering that Mr. Davis is but 25 years of age, we would hold his example as one well worthy of being followed by engineers in general. To those who are inclined to take things easily, and let them pass as "good enough," or "none of my look out," Mr. Davis' example is especially recommended.

Young engineers who keep their eyes, books, and technical papers always open, are the ones who can best be expected to answer questions and run engines. The man whose favorite publication is the *Police News*, will not usually be heard from as an engineer until after the explosion of boilers in his charge.

We have received from Prof. R. H. Thurston, Ithaca, N. Y., a 34-page pamphlet report to the trustees of Cornell University on the schools of mechanical engineering and mechanic arts, prepared by him as director of Sibley College, with special reference to the condition and prospects of that department of the institution. It contains much that will be of value to persons interested in the subject of technical education.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(345) **M., Salina, Kansas, asks:** Should not the valve of a steam-engine be so set as to take enough steam at the piston end to overcome the decrease in piston area caused by the piston-rod? *A.*—In ordinary practice, it would not be advisable. There would be danger that the engine would not work smoothly if it was attempted.

(346) **R. T. W., Norwich, Conn., asks: 1.** What are the dimensions suitable for the valve-gear of an engine 11½″×3″, to cut off at ¾-stroke? *A.*—Steam ports, ½″×¾″; steam lap, ¼″; travel of valve, ½″. 2. What is the best material, and size of a boiler, suitable for above engine? *A.*—Iron: About 8 or 10 feet heating surface. 3. What would be the power at 150 revolutions? *A.*—About 1 6th horse-power.

(347) **J. G. R., Chemnitz, Saxony, asks:** Why is the twist of drills increased with the distance from the cutting edge? *A.*—To provide increased space for the cuttings, and to remove them quicker from the cutting edge of the drill.

(348) **J. C. H., North Adams, Mass., asks** how to make the liquid bronze which is sometimes used on steam radiators? *A.*—Try mixing the bronze powder with a little spirits of wine varnish, and apply to the radiators while they are heated to a greater degree than the hand will bear.

(349) **C. H. W. W——, New York, N. Y.,** writes: I want to temper drills 8-1000″ in diameter. How can I keep them from springing? *A.*—Harden by heating and plunging into a cake of beeswax. Do not try to temper the whole length of the drill. It is not generally necessary to draw the temper when hardened by this method.

(350) **Toolmaker, Athens, Pa., writes:** In tempering two pieces of steel of the same size, both made from the same bar, one shrunk 1-64″, while the other did not shrink at all: what was the reason? *A.*—The trouble was probably caused by a difference in the amount of carbon contained in the steel, which caused one piece to harden and shrink more than the other

(351) **M. J. L., Wahpeton, Dakota, asks:** 1. What is the effect of tallow in a steam boiler? *A.*—A large quantity of tallow in a steam boiler would probably cause a deposit on some parts of the boiler. Its presence is not desirable. 2. Will tallow gum the cylinder of an engine? *A.*—It will, if used to excess. Some engineers claim that commercial tallow contains an acid which corrodes the cylinder.

(352) **J. L., Indianapolis, Ind., writes:** 1. What is the rule for finding the angle which a tooth should be set at, on a worm-wheel, the diameter and pitch of screw being given? *A.*—Divide the pitch by the pitch circumference. The tangent of the quotient will be the answer in degrees. 2. Given a worm 6″ in diameter, 1½″ pitch; required, angle of tooth on wheel? *A.*—1½÷6×3.141=.07959, tangent=4° 12′.=angle of tooth.

(353) **S. W., Reading, Pa., asks** if the teeth of a file be ground off, and the file annealed, can the steel be worked into good metal-cutting tools? *A.*—File steel is not tool steel; still, some tools made of it work fairly well. 2. What is *brake* power? *A.*—As we understand the term, it applies to measurements of power obtained by use of a friction-brake. 3. Is copper a good and safe material for boilers and rivets? *A.*—We prefer iron. The life of a copper boiler is short. They are used in some steam fire-engines, as they generate steam quickly. Copper boilers will require great care and close watching.

(354) **C. O. W., writes:** What kind of oil is best for cutting threads on steel in the lathe? *A.*—We prefer lard oil, but its cost is a serious objection. Common "black oil" gives good results. 2. How much smaller than the desired size should a tap be made to allow for expansion in tempering? *A.*—The expansion caused by tempering is offset by the shrinking caused by hardening. In most cases the shrinkage exceeds the expansion. 3. Should steel, of which taps are to be made, be forged, or cut from the bar? *A.*—They should be made from the bar, unless their shape leads to excessive waste. In that case, the taps may be forged, taking care to leave sufficient stock to enable all parts decarbonized in annealing to be turned off while shaping the tap.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

T. M. Parker, Steel Stamps, Stencils, Hart'f'd, Ct.

J. Clayton, Air Compressors, Rock Drills. 43 Dey st, N Y

Edw. Sears, wood engraver, 48 Beekman st., N.Y.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

Tack, Wire, and Shoe Nail Machinery; Wm. A. Sweetser, Brockton, Mass.

Steel shank, wire nail, shoe nail and tack machinery. Keith & Trufant, Campello, Mass.

Tack and Wire Nail Machinery, made by the Willets Mfg. Co., Providence, R. I.

The Best Upright Hammers run by belt are made by W P. Duncan & Co., Bellefonte, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Patent attorney and expert. Machine designs and details. Wm. H. Weightman, 82 Astor House, N.Y.

Foot-Power Machinery for workshop use, sent on trial if desired. W. F. & Jno. Barnes, Rockford, Ill.

Lyman's Gear Chart. How to lay out gear teeth Price, 50c. E. Lyman, C. E., New Haven, Conn.

Six-spindle Gang Boring Machines, manufactured by Williams, White & Co., Moline, Ill.

Improved Labor-Saving Upright Drills. 20 in. to 36 in. inclusive. Currier & Snyder, Worcester, Mass.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y

Engine Lathes, Hand Lathes, and other fine tools. Assortment large; prices low. Frasse & Co., 62 Chatham st., N. Y.

E. Merritt & Co., Brockton, Mass., established 1859, only manufacturers of a complete line of Tack and Nail Machinery. Send for circulars.

Files recut without drawing temper, about one-half usual prices; samples recut free; prices on application. The Acme Co., Collinsville, Conn.

Curtis Pressure Regulators, Curtis Return Trap, Curtis Damper Regulator. See Dec 5, p. 13. Send for circular No. 17, Curtis Reg. Co., Boston, Mass.

"Complete Practical Machinist," $2.50; "Mechanical Drawing Self-Taught;" $4. Books for workmen. Joshua Rose, Box 3306, New York City.

Screw oiler, for chairs or stools; pat. June 16, '85; will sell Western, Southern, and Pacific States; address L. Postawka & Co., Cambridgeport, Mass.

Kellam's Pressure Regulator—used in heating system of 11-story building, Madison ave., N. Y.,—saved, last season, $2,000 over previous season. Hine & Robertson, 12 Cortlandt street, New York.

Locomotive Engine Running and Management. By Angus Sinclair. Gives full directions about handling and repairing locomotives; instructs how to design valve gear and set valves; Westinghouse air brake explained by aid of engravings. Price, $2. For sale by *National Car Builder*, 187 Dearborn st., Chicago, Ill.

Every young man who aspires to be either a mechanic, merchant, or manufacturer, owes it to himself that he become thoroughly familiar with the writings of Chordal. John Wiley & Sons, 15 Astor Place, N. Y., have issued a new and enlarged 12 mo edition of "Extracts from Chordal's Letters." Handsomely bound in cloth, with over 50 illustrations. Price, $2. Discount of 25 per cent. on orders for five or more copies.

MANUFACTURES

Gallatin, Tenn., has decided to have waterworks.

Big Rapids, Mich., is to have additional waterworks.

Ames & Son will build a sash and blind factory at East Syracuse, N. Y.

Au Sable, Mich., will heat their village hall, jail and hose-tower by steam.

Avery & Erwin propose to erect a $40,000 furniture factory at Ashville, N. C.

Geo. McKim, Martin's Ferry, Ohio, is to build a factory for the manufacture of nail machines.

N. W. McAfee & Co. intend to establish brick, terra-cotta and pottery works at Talladega, Ala.

Sing Sing and Hastings, N. Y., have each empowered their boards of trustees to establish water works.

A large pulp mill will be built at Lisbon Falls, Maine, next season. $75,000 to $100,000 will be invested.

A six-story brick factory building is to be erected by the Bissell Carpet Sweeper Company, Grand Rapids, Mich.

Bollinger Bros., Dandridge, Tenn., will build a new foundry and machine shop at some point in East Tennessee.

Two large hydraulic forging presses are to be erected immediately by the Pittsburgh Bessemer Steel Company.

The Snead Iron Co., Louisville, Ky., will erect and fill with machinery an addition to their foundry, to cost $7,000.

The Simonds Mfg. Co., Fitchburg, Mass., are developing the new business of making steel shot.—*Journal of Progress.*

The Hanging Rock Stove Co., Hanging Rock, O., have purchased the old foundry of F. & L. Kahn Bros, at that place.

John B. Hastings, Ironton, Ohio, is organizing a stock company for the erection of a nail factory at Charleston, W. Va.

$10,000 has been raised by D. M. Parker and others to build a cotton seed oil mill and guano factory at Conyers, Fla.

Cape May, N. J., expects to be forced to bring an additional supply of water from the mainland, at an estimated cost of $25,000.

Marshall & Co., Leeds, England, are negotiating for land in Newark, N. J., where they intend to establish a linen thread factory.

The Danville Nail and Manufacturing Co., Danville, Pa., will increase their stock to $250,000, and add steel works to their property.

W. A. Smith and A. J. Blackwelder, Concord, N. C., are starting subscriptions for stock in a tobacco factory to be built at that place.

The receiver of the Wilson Sewing Machine Co., of Wallingford, Conn., has been authorized by the courts to sell the machinery and real estate.

Pay Director A. H. Gilman, 27 State street, New York, invites proposals for furnishing tools for use in yards and shop of the Brooklyn Navy-Yard.

E. Nicholson, Cleveland, Ohio, has purchased the large foundry at New Philadelphia, Ohio, and will put it in shape at once, possibly making steel castings.

The Volker & Felthousen Mfg. Co., 118 Church street, Buffalo, N. Y., has been organized to succeed E. G. Felthousen in his specialties, oil pumps, cups, etc.

The Sterling Foundry Co., Greenwich, Conn., has been incorporated with capital stock of $12,000, and works are now in course of construction for the manufacture of stoves, ranges, oil stoves, etc.

The Rollstone Machine Co., Fitchburg, Mass., are about to go into the manufacture of refrigerating machines.—*Journal of Progress.*

Aultman & Co.'s Buckeye Mower and Reaper Works, Canton, Ohio, have recently started up with 100 men in their wood department, and by the holidays expect to have all departments working full force.

The Steam Users' Directory Co., of No. 30 Vesey street, N. Y., have in press, and will shortly issue, a directory of steam users and boiler owners in the cities of New York, Brooklyn, N. Y., and Jersey City, N. J.

The Hartford Paper Company, at Pequonnock, Conn., are making extensive repairs and putting in improved machinery capable of nearly doubling their capacity, with but slight addition to the working force.

Wm. H. Woody, master boilermaker, Norfolk Navy-Yard, Norfolk, Va., writes us that it is proposed to erect there a set of vertical rolls for use on heavy boiler plates, if the necessary arrangements can be made.

A three-story frame foundry and machine shop is to be built on the south side of Frost street, near Union avenue, Brooklyn, N. Y. Cost, $5,000. Owners, Coyne & Delaney, 145 Mulberry street, New York City; architects and builders, C. L. Johnson's Sons.

The Cuyahoga Falls Rolling Mill Co. have secured a two years' lease of the Crucible Steel Works in Cleveland, Ohio, with the privilege of purchasing at a certain price. It is the intention to place the works, under management of James Ring, in operation at once.

E. E. Garvin & Co., 139 to 143 Centre street, New York, have issued, under date of November, 1885, a 56-page pamphlet catalogue, illustrating and describing their line of machine tools, including milling machines, drill presses, hand lathes, cutter grinders, tapping machines, etc.

Beginning Nov. 16, the Cumberland Nail and Iron Works, Cumberland, Pa., made an increase of five per cent. in wages to the hands in their various mills. This company resumed operations about a month ago, when a six months' strike was ended by an increase of 10 per cent. in wages. They employ 400 hands.

Probably the greatest days' threshing ever done in the State of Michigan in one day of eleven hours, was done October 16th by Henry Weiser, of Ionia, with his new "Advance" threshing-machine rig, manufactured by the Case & Willard Threshing Co., of Battle Creek, Mich. The amount threshed was 2,244 bushels of wheat, an average of 204 bushels per hour.

The Billings & Spencer Co., Hartford, Conn., have recently brought out a new intermediate size, 5-inch, of the Billings patent adjustable pocket wrench, which we illustrated in our Nov., 1878, issue, and which has become so favorably known both in this country and abroad for bicycle and other uses. Hitherto the sizes have been 4″ and 6″. The new size opens 1¼″, and, like the others, is finished in a first-class manner, being graduated on the bar to 32nds of an inch. It is believed the new size will become a favorite among machinists and toolmakers.

A project is on foot for the establishment of an extensive watch factory in Trenton, N. J. Congressman Brewer, John Moses, and others are interested in the movement, and they have been to New England inspecting the factories there. They think of transferring the business of one of the New England concerns here, and they are assured already of a good market for a cheap grade of silver watches. It is believed that the factory will be started early next year, and there will be employment for several hundred men.—*World.*

The National Pipe Bending Co., New Haven, Conn., have issued a new card price-list of the National Feed-Water Heaters, with some changes in prices, taking effect Dec. 1, 1885. They have arranged for general agencies for sale of their heaters at Boston and New York. The Jarvis Engineering Co., 61 Oliver street, Boston, Mass., have the general agency for all of New England east of the Connecticut river, and Westinghouse, Church, Kerr & Co., 17 Cortlandt street, New York, are general agents for Vermont, the Middle States, Maryland, Delaware, Virginia, and West Virginia.

The L. B. Flanders Machine Works, of Philadelphia, write us: We are pleased to announce a growing increase in orders for our special tools for railway repair shops, and inquiries are very numerous. Have recently shipped our patent portable valve-seat, rotary planing machines to the Baltimore and Ohio Railway Company, Lehigh Valley Railway Company, and Utica and Black River Railway Company; patent portable locomotive cylinder machine to the Atchison, Topeka and Santa Fe Railway Company; radius link planer attachment to Savannah, Florida and Western Railway Company; patent portable crank-pin machine to the Boston and Albany Railway Company; Otto's patent flue-cleaning machine to the Pittsburgh and Lake Erie Railway Company. Other orders on file. Our cylinder boring machines for boring steam-engine cylinders, etc., in place, are, some of them, in almost daily use. Our specialty of repairing Corliss engines, keeps our force in this department very busy. We shall soon be obliged to put on more hands to meet the demands upon us.

The Oneida Steam-Engine & Foundry Company, Oneida, N. Y., chuck manufacturers, write us: "Trade is good."

Wm. H. Warren, Worcester, Mass, has just received an order from the U. S. Government for one each of his largest shapers and radial drills.

C. E. & W. H. Kline have leased the Selin's Grove (Pa.) foundry and machine shop, with the intention of manufacturing small engines, light machinery, and general castings.

The Saginaw City, Mich., local committee, appointed to raise $20,000 bonus to procure an extension of the Saginaw, Tuscola & Huron Railroad, from Bayport to Bad Axe, has succeeded in raising the amount, and the work will be commenced at once.

Machinists' Supplies and Iron.

NEW YORK, Dec. 2, 1885.

The market has ruled quiet and firm, with a moderate demand for small lots required for current wants.

A desire is evinced in some quarters to contract for next year's delivery on the basis of present prices for iron, but furnace-men are reluctant to entertain such orders and thus far have not named prices for future deliveries.

Iron—American Pig; values are without quotable change, but must be taken as nominal so far as they represent the basis of business from first hands, but from second hands an advance of 50 cents is generally asked. We quote Standard Lehigh and North River brands, $18 to $18.50 at tidewater, for No. 1 X Foundry; $16.50 to $17 for No. 2 X Foundry, and $14.50 to $15.50 for Gray Forge at furnace.

Scotch Pig—The Glasgow market is easier and ocean freights are lower, but the market here is without quotable change. The demand continues quite moderate and confined almost wholly to the small requirements of regular consumers. We quote Coltness, $19.50 to $20; Glengarnock, $18 50 to $19 to arrive; Gartsherrie, $19 to $19.50; Summerlee, $19 to $19.50; Eglinton, $17.50 to $18; Langloan, $19.50, and Dalmellington, $18.25.

Lead—There has been no change in manufacturers' prices. Spot lots are scarce, and have advanced to $4.45 to $4.50, and $4.40 to $4.55 for Pueblo.

Copper—Quiet but slightly lower. Lake at 11 to 11¼c. Demand moderate.

Tin—Market easier; demand light. Jobbing lots Banca quoted— ; Straits and Malacca, 21c cash.

Spelter—Quiet and steady. Refined, 4.35c. to 4.40c.

Antimony—Hallett's 8 40c.; Cookson's, 9.45c.

WANTED

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Situation as foreman of machine shop; good refences given. Address Buckeye, AM. MACHINIST.

Situation as foreman or supt. of machine shop; good references. Address R., AM. MACHINIST.

Position wanted as draftsman; is practical machinist, and capable of designing. Address, Box 277, AM. MACHINIST.

Wanted—By young man, position as timekeeper, bookkeeper, or shipping clerk, in manufacturing concern. Address, N. B. E., AM. MACHINIST.

Wanted—Foremanship of foundry; experienced in mining, milling, engine and railroad work; references. Address, Energy, AM. MACHINIST.

Wanted—Earnest, energetic young man, with some knowledge of boilers and steam appliances, as canvasser. Address, by letter only, with references, L. M. Moyes, 32 N 5th street, Phila, Pa.

Wanted—A practical springmaker, with experience in the manufacture of light and heavy spiral springs, of great accuracy. Address, with reference, stating qualifications and wages wanted, Spiral Springs, AM. MACHINIST.

Wanted—By practical mechanic, designer and draftsman, position as supt. or foreman of machine works; have had large experience handling men and systematizing work; best reference given; corresp'ce solicited. Address Box 486, Waterbury, Ct.

Wanted—A first-class brass finisher; one who has also some experience as machinist; must be a live man and competent to take charge of a shop doing all kinds of brass and iron work, especially jobbing and light machinery, in a city near New York; must speak German and English. Address J. E.—AM. MACHINIST.

MISCELLANEOUS WANTS

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Engineering specialties; send for price-list. Crescent Mfg. Co., Cleveland, Ohio.

Wanted—Patented articles to manufacture and introduce. Box 88, Newark, N. J.

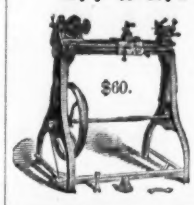
To make room for larger tool, will sell cheap, for cash, a planer 42"x42"x12', in good order. Address P. O. Box 2085, Bridgeport, Conn.

Machine shop with small expense wants patented article to build. H.S.Phillips & Co., Burlington, N J.

Special mch's. for any kind of mfg. designed to order. Also plain and autom'c eng's. Send for circular and refs. Weston & Smith, Syracuse, N. Y.

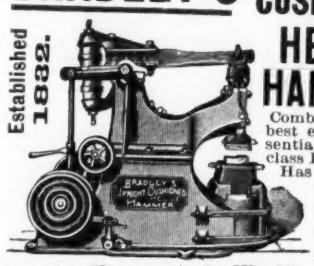
For Sale—A Dexter Automatic Cut-off Engine, 75 horse-power; 3 years old; can show cards of 100 H.P.; delivery Jan. 1, 1886, when we will replace it by larger engine of same make; engine now running at works, Paterson, N. J. Kearney & Foot Co., 101 Chambers street, N. Y.

CHANDLER & FARQUHAR,
177 & 179 Washington St.,
BOSTON, MASS.

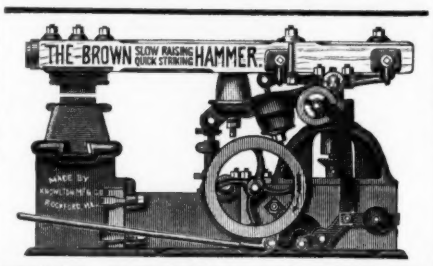


TOOLS AND SUPPLIES
—FOR—
Machinists, Plumbers, Gas Fitters, Electricians, Model Makers, Roller Skate Makers, Amateurs, etc.
Send for Catalogue B.

BRADLEY'S UPRIGHT CUSHIONED HELVE HAMMER



Established 1832.
Combines all the best elements essential in a first-class Hammer. Has more good points, does more and better work and costs less for repairs than any other **Hammer** in the **World.**
BRADLEY & CO. Syracuse, N.Y.



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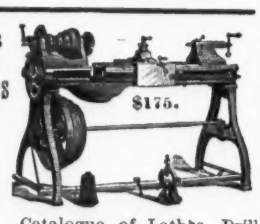

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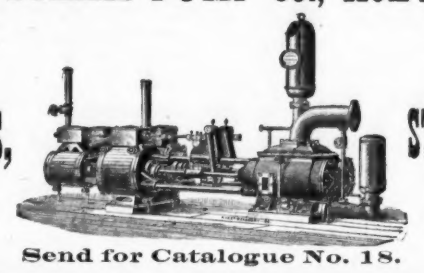

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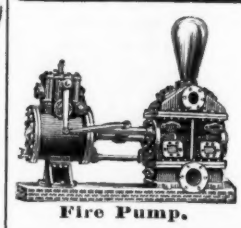

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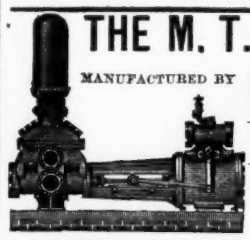

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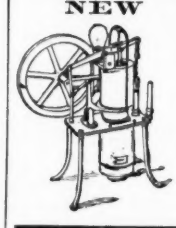

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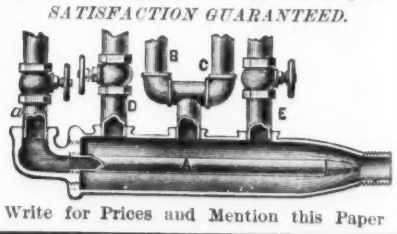

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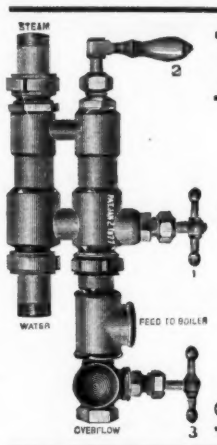

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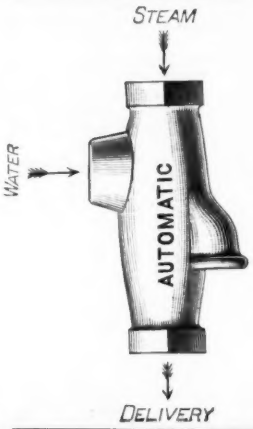

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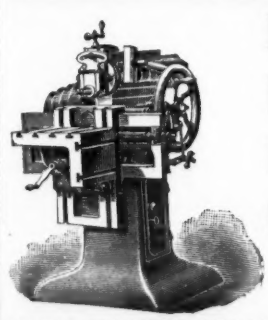

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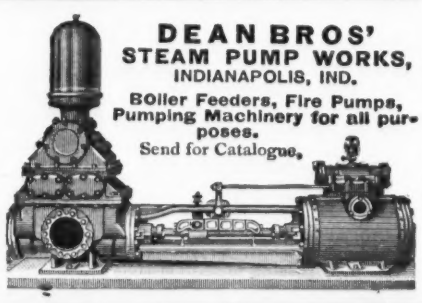

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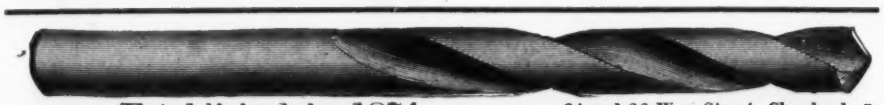

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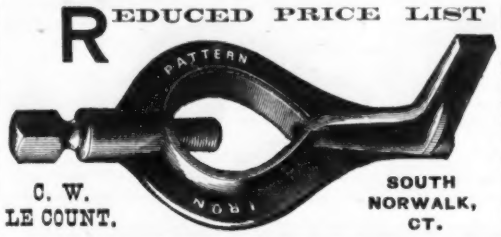

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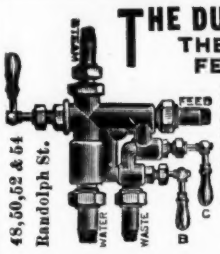

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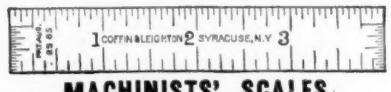

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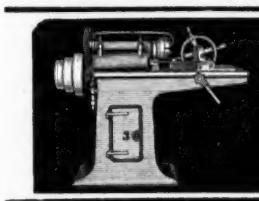

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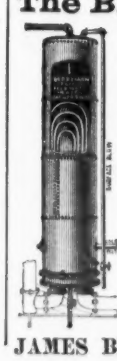

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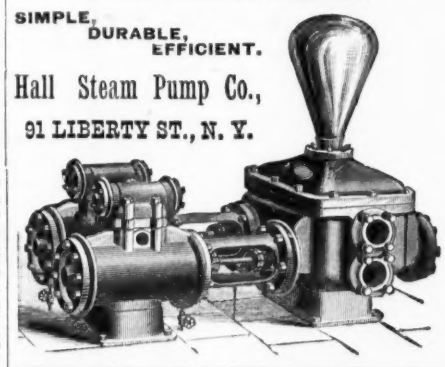

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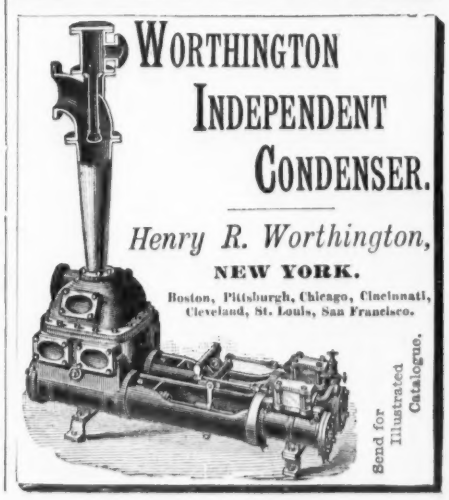

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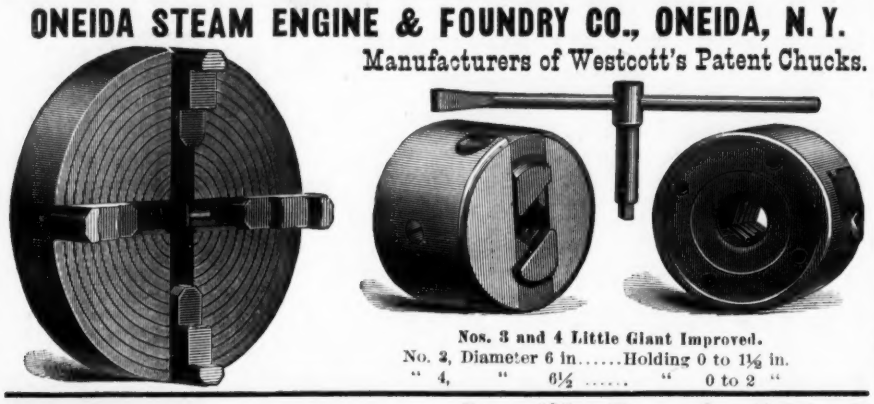

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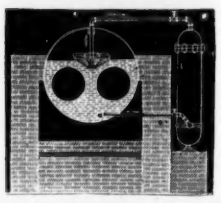

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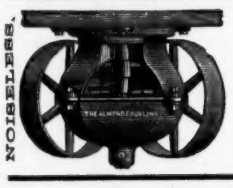

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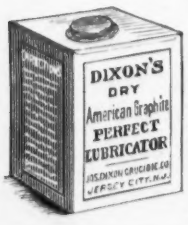

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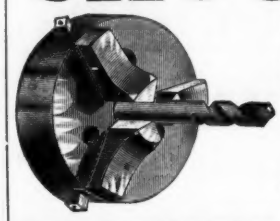

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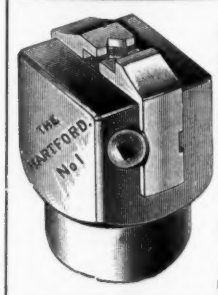

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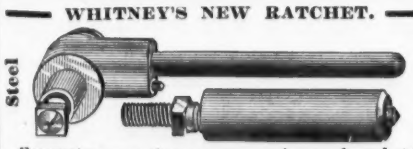

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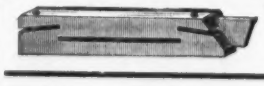

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NOTICE.

Week before last we published, under this heading, references to a small portion of the practical articles that have been specially prepared for the AMERICAN MACHINIST, and have appeared in our columns during the last few months. Last week we published an additional list. We append another list below. No other mechanical journal in this country has or ever has had such a collection of practical articles, by writers of well known ability, as are presented in these columns week by week. Every issue gives information that is taken up and applied in the shops and factories in various parts of the country. Copies containing these articles can be readily obtained by ordering of any newsdealer, or by writing to this office, at 5 cents per copy.

Wm. M. Barr.

Kaolin and Plaster of Paris as a Boiler Covering May 17, 1884
Another Explosion in a Pump Plunger. May 31 1884

Frank H. Ball.

Balancing the Reciprocating Parts of Steam Engines January 3, and February 21, 1885.

Frank H. Richards.

Something About Chucks. January 12, 1884
Running a Lathe. January 12; February 23; March 1; May 3, 17, 1884
Grinding and Using Cutting Tools. May 2, 1885
Grinding Tools Again. June 6, 1885
Screw Cutting on the Engine Lathe. June 13, 1885
Pay Days and Early Closing. August 15, 1885.
Twist Drills and Twisted Arithmetic. July 25, 1885.

George Escol Sellers.

Early Engineering Reminiscences. June 7, 14; July 12; August 9, 23; October 11, 25; November 1; December 13, 20, 1884. February 28 March 14; April 11, August 22, 1885

John W. Nystrom.

Inertia Diagram. Dec. 27, 1884
Inertia. Aug. 30, 1884

George Marshall.

The Result of Imperfect Setting of Horizontal Tubular Boilers. May 24, 1884.
Form and Material of Boilers. June 14, 1884
Agricultural Boilers. September 27, 1884
Boiler Chimneys Considered from an Economical Standpoint. August 16, 1884
Boiler Domes. Flanging. May 3, 1884
Braces and Boilers. May 17, 1884
Points in Boiler Construction. August 9, 1884
Thoughts and Hints on Boiler Construction. July , 1884
Boiler Fittings, Boiler Tests and Inspection. Feb. 16, 1884
Boiler Plate Stamps, Laminated Plates and Steel Plates. April 26, 1884
Use of Mild Steel in Boiler Construction. March 8, 15, 1884
Safe and Unsafe Methods of Boiler-Making. Jan 12, 1884
Boiler Braces May 3, 1884
Boiler Repairing. May 10, 1884
Objections to Boilers of the Locomotive Type April 5, 1884
The Care of Boilers. January 26, 1884
English *versus* American Boilers. July 19, 1884
Laying Out Sheet Iron and Boiler Work. August 15, 1885

Fred. J. Miller.

Universal and Combination Lathe Chucks. May 24, 1884
Making Cutters for Involute Gear Teeth. February 16, 1884
Milling Machines, Tools and Fixtures. September 20, 1884
Pitch of Milling Cutter Teeth October 4, 1884

L. C. Jewett.

Draft and Finish of Patterns May 31, 1884.
Making 18" Face Pulley from a 12" Pattern. November 15, 1884

Thos. D. West.

Sound Castings. December 6, 1884
Small Castings. March 15 1884
Momentum and Rules for Weighting Down Copes. August 2, and July 26, 1884
Green Sand Cores. January 12, 1884
Foundry Cranes. August 23, 30, and September 6, 1884
Oddity and Science in the Construction of Cupolas . May 10, 1884
Small Cupolas. January 19, 1884
Cylinder Moulding. March 22, 1884
Sweeping Grooved Cone Drums. April 19, 1884
Elements and Manufacture of Foundry Facings. May 24, 31, 1884
Foundry Plant. June 28, 1884
Heavy and Light Work Skimming Gates. November 8, 1884
Intelligence in Melting February 2, 1884
The Mould Board. March 15, 1884
Ovens and Pits. June 28, 1884
Pipe Patterns. January 12, 1884

Isaac Whitehead.

Construction Gear Patterns. May 24, 1884.
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Copying and Making Patterns From an Old Propeller Wheel. March 1884
How to Strike Up a Propeller Wheel. March 15, 1884

S. W. Goodyear.

Personal Recollections. January 12, February 9 March 15, 1884; July 18, 1885
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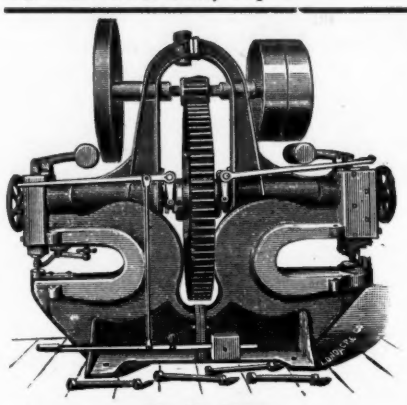

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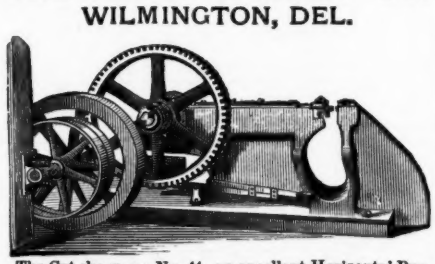

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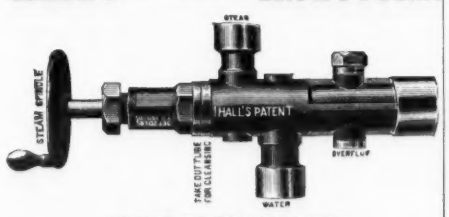

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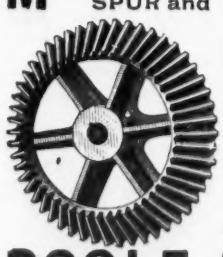

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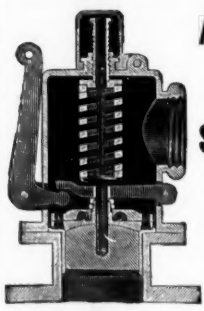

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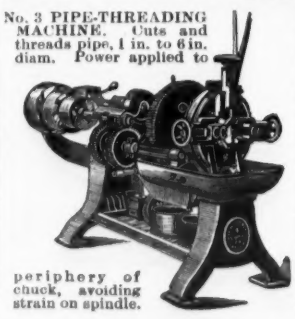

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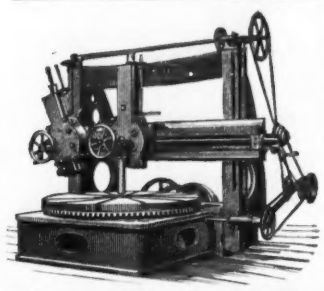

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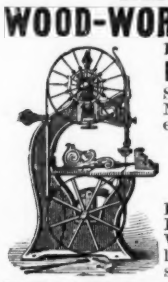

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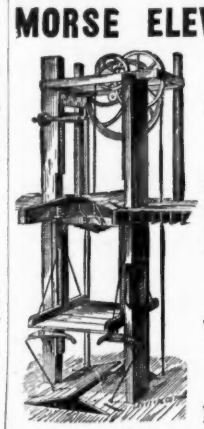

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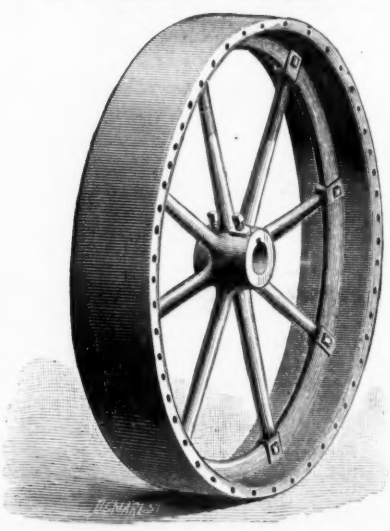

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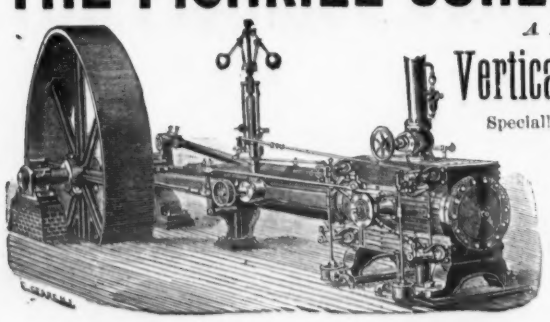

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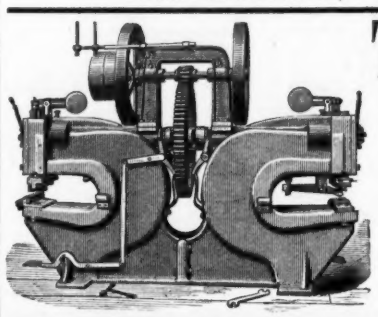

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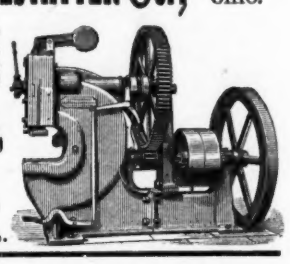

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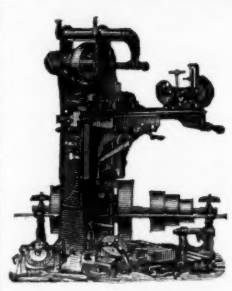

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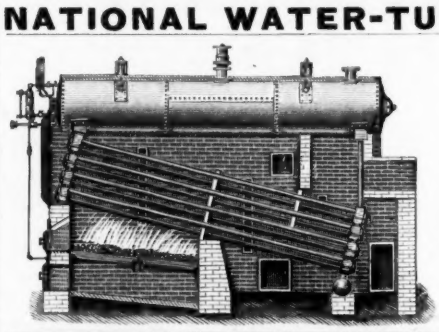

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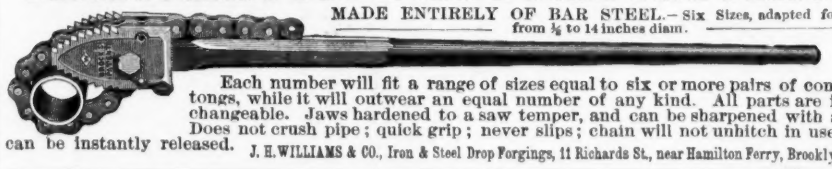

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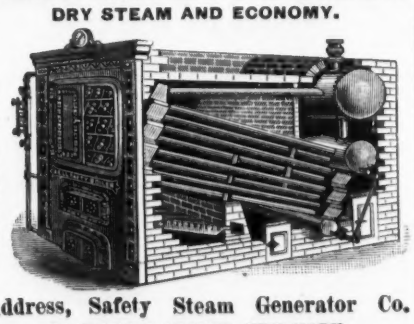

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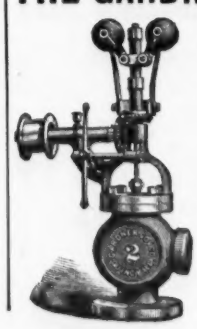

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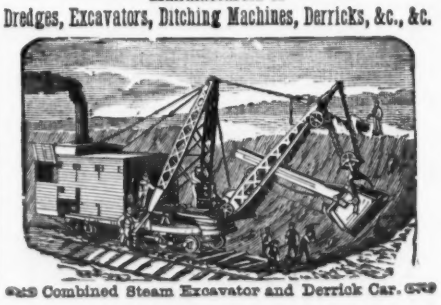

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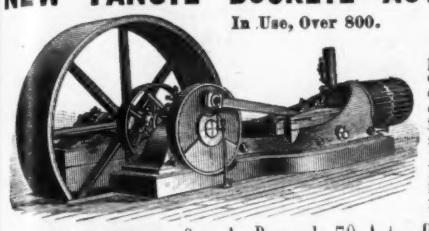

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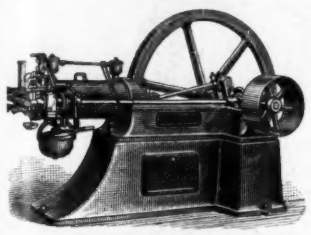

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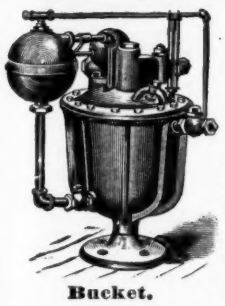

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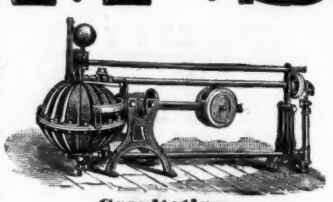

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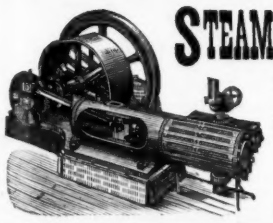

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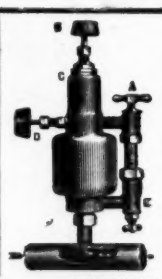

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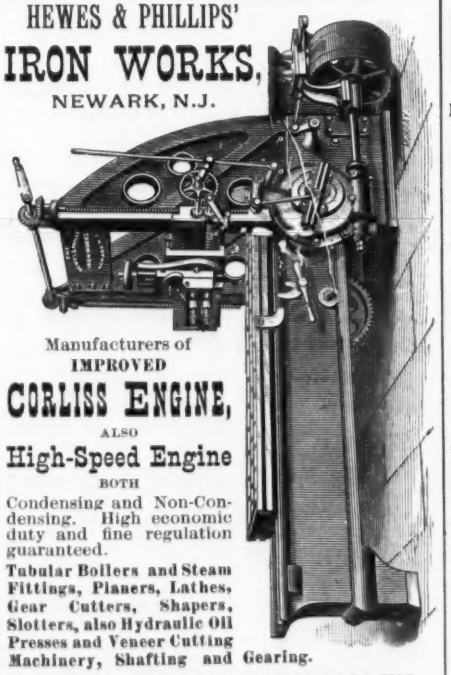

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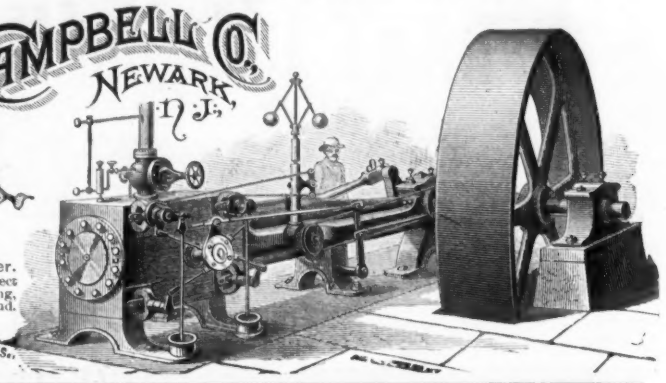

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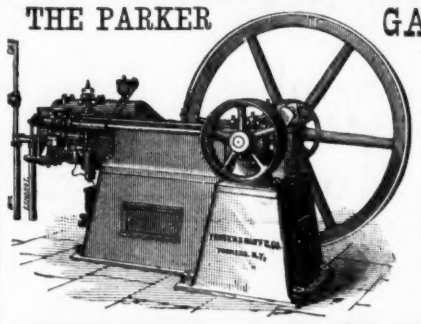

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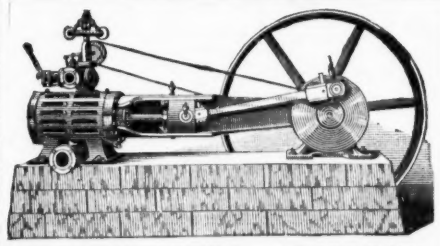

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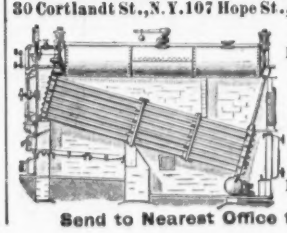

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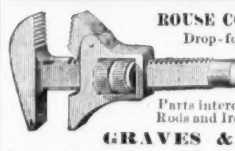

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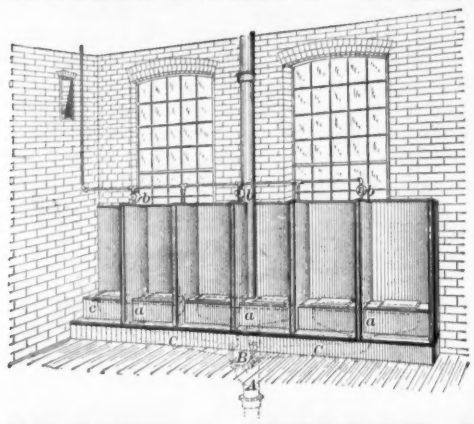

The accompanying cut shows an arrangement for closets in use at our works for several years and which has given universal satisfaction. The latrines, *a*, one of which answers for two closets, are filled to within a few inches of the top with water, an overflow in a valve in the center of each preventing their being filled too full. The water is let into the latrines through a pipe which extends around the inside of the same, and the pipe, being perforated on the under side, washes the sides. These latrines are emptied once or twice each day by raising the valve by the rod *b*, allowing the contents to escape through a soil pipe. The closets should be ventilated under the seats into the chimney where possible, as shown by an opening at *c*. Special pipes, connecting with upright soil pipe, are shown at *A*, *B*, and *C*.

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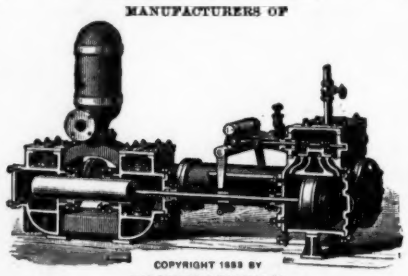

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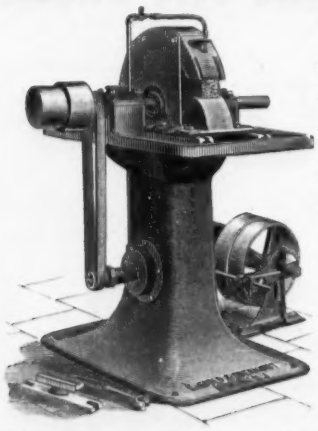

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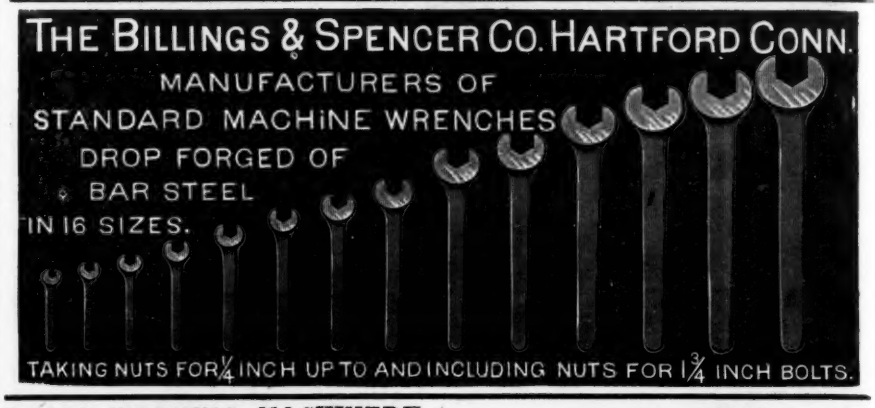

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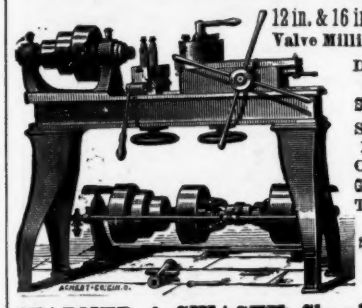

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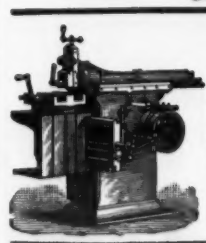

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